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# ***JPRS Report***

# **Science & Technology**

***Europe/International  
Economic Competitiveness***

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# Science & Technology

## Europe/International

### Economic Competitiveness

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## CONTENTS

25 March 1993

### WEST EUROPE

#### SCIENCE & TECHNOLOGY POLICY

CERN Director Sees Dangers to German Research [Dr. Herwig Schopper; Hamburg DIE WELT, 3 Mar 93]	1
Nation's Technological Position Seen 'Unfavorable' [Michel Kerres; Rotterdam NRC HANDELSBLAD, 13 Feb 93]	1
Germany: Leybold Official Discusses Export Controls on Dual-Use Materials [Dr. Heidsieck Interview; Duesseldorf VDI NACHRICHTEN, 29 Jan 93]	4
Swiss National Effort to Advance High Technology	5
Biotechnology Research [Turhan Boysan; Geneva JOURNAL DE GENEVE, 13-14 Feb 93]	5
Neural Network Research [Nicolas Henchoz; Geneva JOURNAL DE GENEVE, 13-14 Feb 93]	6
Professor Sees German Basic Research in Danger [Prof. Walter Greiner; Frankfurt/Main FRANKFURTER ALLGEMEINE, 10 Feb 93]	6
France: Industry Gets Advanced Materials Aid [Paris COMPOSITES ET NOUVEAUX MATERIAUX, 1 Feb 93]	8
German Research Ministry Launches Surface, Coating Technologies Program [Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN, 15 Jan 93]	9
Italy: Microelectronics Development Associations Established [Genoa GE.R.I.CO. NEWS, Jan 93]	10
Italian Research Institute Assigned EC Microelectronics Program [Genoa GE.R.I.CO. NEWS, Jan 93]	12
Record of German Research Under Outgoing Minister Discussed [Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN, 28 Jan 93]	13
German Research Minister Makes Case for R&D Promotion [Norbert Sturm; Munich SUEDEDEUTSCHE ZEITUNG, 23 Feb 93]	15
Italy: Science Park Project Presented [Turin MEDIA DUEMILA, Feb 93]	16
Italy: Achievements of Agency for European Research [Milan MEDIAPLUSNEWS, Jan 93]	16

#### CORPORATE ALLIANCES

France: Northern Telecom, Matra Alliance Developments [Paris 01 Informatique, 19 Feb 93]	17
Matra Buys Renault CAD/CAM Subsidiary [Paris PRODUCTIQUE/AFFAIRES, 20 Jan 93]	17
Framatome Connectors Buys Daut & Rietz [Jean-Pierre Jolivet; Paris L'USINE NOUVELLE, 28 Jan 93]	18

#### CORPORATE STRATEGIES

Temic's Plans to Become Global Microelectronics Firm [Georg Heller; Duesseldorf HANDELSBLATT, 9 Feb 93]	19
Technological Competitiveness of German Industry Discussed [Bonn TECHNOLOGIE-NACHRICHTEN PROGRAMM-INFORMATIONEN, 27 Dec 92]	21
France: Thomson's Restructuring Strategy Discussed [Pierre-Angel Gay, Caroline Monnot; Paris LE MONDE, 5 Feb 93]	36

#### EAST-WEST RELATIONS

Germany: ABB To Build Copper Alloy Recycling Factory in Ukraine [Eschborn NACHRICHTEN FUER AUSSENHANDEL, 22 Feb 93]	38
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**EUROPE-ASIA RELATIONS**

China Involved in DASA, Fokker Controversy [Munich SUEDEDEUTSCHE ZEITUNG, 22 Feb 93] .....	38
Germany: Nissan Opens Design Center Near Munich [Munich SUEDEDEUTSCHE ZEITUNG, 19 Feb 93] .....	38
Ericsson To Expand Cellular Telephone Network in China [Eschborn NACHRICHTEN FUER AUSSENHANDEL, 22 Feb 93] .....	39

## SCIENCE & TECHNOLOGY POLICY

### CERN Director Sees Dangers to German Research

93P60181 Hamburg *DIE WELT* in German 3 Mar 93  
p 7

[Article by Dr. Herwig Schopper]

[Text] Society and politics in Germany, but also in many other countries, are faced with great challenges: unemployment, damage to the environment, problems of reunification in Germany and many others.

Who would be surprised that science and technological development are losing priority with the politicians, but also in the awareness of the general public? Numerous calls for help by the chairmen of research organizations are one indication of this. Is this an inevitable development or are we risking our long term chances?

A decent future can only be built with the aid of more science, and technology based on this science. Only its help can create the prerequisites for providing a decent existence, in present terms, for a broad range of the population and not just a thin upper class. This is how the prerequisites for democracy will be created, not by ideologies. It is a generally accepted proposition, I believe, that a country like Germany, which is poor in raw materials, cannot be competitive without a scientific/technical foundation. Therefore, research and technical development must be promoted on a broad basis, from basic research to specific practical applications. Of course, it is understandable that the immediate, urgent problems shorten perspectives, but it would be irresponsible to allow this to make us neglect the longer term future.

Thanks to the great efforts in the last few decades, German research and development in most areas has reached a level that need not fear comparison in the international arena.

We are on the way towards wasting these accomplishments. Thus it must cause concern if "extra needs caused by reunification" are not properly taken into account by the budgets, or if research subsidies are seen as part of general subsidies and regarded in this context as candidates for cuts. Unfortunately, in many cases industry (and not just in our country) is limiting its expenditures for research and development, instead of preparing intensively for the future.

What must be done? If it is a matter of showing solidarity, science too must do its part. But one should keep the current difficulties from causing long term, irreparable damage.

Science and research are sensitive areas where the wrong signals can cause human and intellectual currents to flow in the wrong direction for decades. What is needed is

long-term, consistent planning which is not dependent upon personal or party contingencies.

Unfortunately, this requirement is opposed in politics by the orientation towards the next election and in industry by the orientation towards short-term profit. There is also great danger in the fact that responsibilities are being pushed back and forth in the current struggle over distribution. Thus the federal government must keep essential authorities and responsibilities in the area of research and development. It must not, by appealing to the constitution, pass these responsibilities off to the *laender*, which are hardly in a position to step into the breach. This also applies to coordinating programs with the European Community. A reference to the fact the EC is increasing activities must not be used as an excuse for cutting back national programs. Much greater efforts will be needed to interpret correctly and apply the often-cited principle of subsidiarity. But scientists too must become more involved and participate more in the setting of priorities.

Finally, it is very important to me that the discussion on supporting research and developments is not limited just to the economic utility. Research into nature is an important part of the cultural activity of humanity, since it helps form our picture and understanding of the world. International scientific cooperation (such as in my area, basic physics research) has promoted in an outstanding way understanding and trust among people of various races, religions, and cultural groups. This fact is of particular importance in the present day.

### Netherlands: Nation's Technological Position Seen 'Unfavorable'

93EN0199A Rotterdam *NRC HANDELSBLAD*  
in Dutch 13 Feb 93 pp 17-18

[Article by Michel Kerres: "Technology in the Netherlands: Weapon With a Crooked Barrel"]

[Text] Not every jewel sparkles. The building at the Nuenen industrial park is matter-of-fact, without pretention. Nothing would indicate the fact that here, between brick walls and old-fashioned linoleum floors, one of the Netherlands' greatest competitive advantages is being expanded on a day-by-day basis.

A display window in the reception area illustrates the work-site of the Center for Construction and Mechatronics (CCM), a special development firm that considers technical solutions. A new radiator coil, a more efficient candy packing machine, a smaller CD-ROM-drive, containers for biological experiments in space, a vital controlling part for the production of microprocessors: the trophies of modern inventors.

Under CCM's roof, know-how and the market are fitted to each other's needs, with new products and production processes as the result. Creativity, embodied in steel, plastics, and electronics. Technology directly transformed into money.



The most important operating capital and the most important basic material of CCM are its 60 employees. The concern owes its existence to the commercial savvy of a well-known inventor, the late Alexandre Horowitz. Among his peers, Horowitz made a name for himself by acquiring 136 patents. Among the public at large, he is known as the inventor of the Philips razor [Norelco electric razor]. Munificent employers, such as Philips and the Technical University of Eindhoven did not prevent Horowitz from working for himself in 1969.

CCM exists by the grace of the greatest resource a Western country can possess at the end of the 20th century: human reason. In the economic competition between nations, human beings count as the secret weapon: expert and creative genius. In the Netherlands, that weapon has a crooked barrel.

In former times a country was considered rich if it had at its disposal mineral resources or a geographic situation that rendered flexible imports of basic materials possible. At the present time, basic materials are of scarcely any consequence in the competition among nations. Japan has the world's best steel industry, despite its lack of coal and steel [as published]. Wealth in terms of basic materials is no longer a guarantee of prosperity. Russia, South Africa, Indonesia, and Chile are blessed with ores, yet they are not members of the exclusive club of wealthy nations. Economic miracles are being accomplished in precisely those countries that are poor in natural resources: Singapore, South Korea, Taiwan.

In the economic struggle between countries, know-how and technology have supplanted natural resources. Know-how plays an increasingly important role in the growth of prosperity. According to the Ministry of Economic Affairs, know-how and technology are responsible for at least half of all economic growth. That includes the importance of healthy industry. Industry is the driving force that develops new knowledge and new technologies in its quest for profits.

Not only have natural resources been driven from their throne; at the present time, they are even considered a curse. Mineral wealth gives rise to complacency and passivity. Anyone who can export oil does not worry about exporting industrial products. The necessity for doing so is lacking. Norway, for example, has no industry of any significance. The bubble of natural gas at Slochteren, which was widely celebrated in the Netherlands, is no longer considered exclusively to be a major windfall for the national economy. At the present time, the disadvantages of the sudden wealth in natural gas are being recognized as well.

Professor J.J. van Duijn, of the Robeco Group, says the discovery of natural gas signified an enormous windfall profit for the economy of the Netherlands. Thanks to the natural gas, the Netherlands no longer had to operate on the knife edge of international competition. Van Duijn compares the Netherlands' economy to a gigantic, rich enterprise that is active in a major market and is scarcely

hindered at all by competition. The operation falls asleep, the beneficial pressure of the market does not keep it on the edge of its seat. In their comfortable position, the country and the enterprises lose their fighting spirit, their willingness to grow. The Netherlands did not use its unexpected wealth in natural gas to improve the competitive position of its economy. The benefits of the natural gas have been used to finance social security, among other things. They have been consumed, not invested. The prosperity of Slochteren gave rise to the slumber of Slochteren.

But the natural gas supplies are finite. Sooner or later, the Netherlands will have to progress, without that support behind it. Then, know-how and technology will have to keep the prosperity up. When that situation comes to pass, the position of the Netherlands is not going to be an altogether favorable one.

The competitive strength of a country in a field as broad as science and technology cannot be captured in a single, clear quantification, in a neat row of figures. The availability of well-trained polytechnic school graduates is not nearly as significant as high-ranking scientific investigation. The universities make their contribution, as do the research laboratories of industrial firms. The development of new products is important, as is the development of new production processes. New knowledge must be "made," but it must also be spread and be applied to a broad area.

In 1991, Technology and Scientific Indicators [TWIN] appeared; it was a bold name for a woeful report. In TWIN, the Netherlands' potential for knowledge is laid out in small portions. In nearly every instance, the indicators are pointing in the wrong direction.

Education in the Netherlands, for example, seems to fit the needs of Netherlands industry, just as a hand fits its glove. Over the last 10 to 15 years, the Netherlands will experience lamentable shortages of scientists in just those areas it needs most. One study even puts the shortfall at 12,000 researchers. The greatest need will be in mathematics and the natural sciences. Then there is fear of an increasing shortage of lower technical school graduates, polytechnic graduates, and college of advanced technology graduates. Unilever's research division in Vlaardingen had the greatest trouble finding enough biochemists last year.

The universities in the Netherlands train a greater than average number of people in foreign languages and the social sciences when compared with the rest of Europe. According to Van Duijn, it is a typical symptom of prosperity: as prosperity increases, so, too, does the number of language experts and jurists. It is not for nought that the United States has so many lawyers. Career choices are made on the basis of considerations of luxury: What is pleasant? Much less thought is given to the question: What is useful and necessary?

In the meantime, the ministries of economic affairs, education, and the sciences are trying to strike a balance,

but it is all progressing slowly. Each year, Minister Ritzen [Minister of Education and Science], tries to shift 3 percent of the money that is earmarked for alpha and gamma training programs [the arts and social sciences] to the exact sciences. Public awareness campaigns on technology—Choose Exact—have hardly had any effect at all.

Not only does the Netherlands train too few people in the exact sciences, consumers, that is, the industrial firms, have little to say concerning the quality and the orientation of the training programs that are available. The government's highest advisory board on science and technology recently had little good to say about the quality of Dutch engineers. Their orientation does not have a sufficiently broad base, and they lack basic skills, such as designing, the Advisory Board on Scientific and Technological Training [AWT] confirmed.

CCM's director, J. Kummeling, engineer, is familiar with these problems from the practical side: "Engineers are often not able to tackle a problem. They can readily deal with modern aids, but they have problems with creative design." They have too little experience "at the plank," as the drawing board is called in Nuenen.

The publications of the academicians are of a high level, but the knowledge is not transformed into practical applications; the number of Dutch patent applications is low compared with the average for the European Community. In addition, the Central Planning Bureau made the discovery that the academics in the beta subjects [the sciences and medicine] are busy addressing problems that do not concern industry in the Netherlands, and that they accumulate knowledge in subjects that are not relevant to Dutch industrial firms. Dutch researchers create quite a stir in medicine and biology, but they produce much less in technology, natural science, electro-technology, and chemistry. The universities are specialized in fundamental research, and within those confines, they frequently devote themselves to the study of the most abstract and least market-oriented subjects.

The lack of sufficient and sufficiently well-trained workers in fields that are relevant to industry should not be laid exclusively at the doors of the government and the universities. Industry itself does too little to restore the unevenness in the offerings. The costs that Dutch firms incur in retraining their workers and in providing additional training for them are below the European average.

In the rich years of the 1980s, industry invested too little in its human capital, confirms Professor A. Roobeck, of the University of Amsterdam. Above all, industry is dealing all too imprudently with those workers who have the least amount of training. That is a short-sighted strategy, because the pressure on the firms to incorporate new discoveries into their production processes is increasing rapidly.

Academicians and technicians form the basis of the "knowledge industry." The sums disbursed for research

and development may be considered the most important barometer for the technological position of a country.

From a comparison of seven industrialized countries, it becomes apparent that investment in research and development over the past five years has fallen off nowhere as much as it has in the Netherlands. Since 1987, these investments have declined from 1.4 percent of the gross domestic product (GDP) to 1.1 percent in 1991. Front-runner Japan invests 2.2 percent of its GDP annually in the development of new products and new production processes.

Japanese, French, and American firms have, in years gone by, always invested more in research and development. The sharp decline in the Netherlands may be attributed, in part, to cut-backs at Philips, the most important research center in the Netherlands, but they cannot account for the decline altogether, either.

From a recent study of investment by industrial branch, conducted by the University of Maastricht, it becomes apparent that only a fraction of Dutch industry can find itself reflected in the European average. An overview of estimated outlays for research and development shows that only the oil industry, the instrument makers, and base metals invest, on the average, somewhat more in their future than do their European competitors. Important industries, such as pharmaceuticals and the foodstuffs industry are sitting right at the European norm, but the lion's share of them remain far behind.

The Netherlands does reasonably well when what is at stake is the application of technology: with the exceptions of robots and information technology, the Netherlands seems to be keeping pace with the rest of Europe.

A revealing picture emerges from the disjointed and often difficult to interpret studies of the technological base of the Netherlands: "On the whole, the technological position of the Netherlands is unfavorable across the board," an official of Economic Affairs summarizes the condition of the Netherlands' secret weapon. The researchers from Maastricht confirm that the Netherlands threatens to lose the competitive battle over commercial research.

For the Netherlands know-how industry, the orange light is glowing: the Netherlands can fritter this warning away, but it still has the opportunity to turn the light to green and expand its competitive advantage. Because the trend is a downward one, it will not be an easy task.

In the open Dutch economy, there are not many production factors that can be controlled directly by the government, except for precisely this one. Governmental efforts in know-how and technology have a spin-off effect that is not entirely unpleasant: it is one form of industrial management in which the common risks may be avoided. Stimulation is not bound to one firm, but it can positively affect an entire branch of industry consisting of domestic as well as foreign firms. In addition,

investments flow via the inhabitants, and they do not disappear into a corporate treasury that is difficult to monitor.

That is not to say that stimulating know-how and technology is not without its problems. In the case of direct subsidies for study that is directed toward the end product, there is the risk of falsifying the competition. Nor is the fact escapable that there will always be difficult and wrong choices, as the Philips high-density television [HDTV] project threatens to illustrate.

In past decades, many firms have completely separated their research divisions from their production sites. For the Netherlands, in most cases, that meant that those divisions with the great opportunities for work—the factories—left the country. Since then, the laboratories no longer have any “natural” homes. The only reason for allowing a research division to exist anywhere—or to move it—is the availability of people and know-how. If the supply of raw materials is better in a foreign country, the laboratories, too, will move across the border, and foreign concerns will move their researchers elsewhere. With too few trained people, and when those who are trained are trained along improper lines, the competitive fight cannot be won in any case.

In the meantime, the existing research facilities are suffering from the current malaise that prevails among the patrons, namely those industrial firms that continue to produce in the Netherlands. The commercial laboratories can thus no longer have a “natural” home port; independent research facilities are at least somewhat dependent upon the industrial patrons in their neighborhoods.

A glance at CCM's order file in Nuenen illustrates this fact quite plainly. An ever-greater portion of the orders comes from the government and semi-governmental facilities. In addition, CCM is relying, to an increasing degree, on the foodstuffs industry, which continues to be well-represented in the Netherlands. The new subsidiary, AutoMeat, delivers, among other things, slaughtering robots for swine to the customer. Orders from the Brabant region—in any case, from the Golden Triangle of Dutch industry—are becoming rare. At present, Philips is letting things slide altogether. With baleful glance, CCM is following the malaise at NedCar and DAF [Van Doorne's automobile factory]. “The problems in the region are terrible,” says Kummeling. Sooner or later, the industrial malaise will have an impact on developmental activities. To quote Kummeling: “Ultimately, there will be lots of blame to go around.”

#### **Germany: Leybold Official Discusses Export Controls on Dual-Use Materials**

93WS0261C Duesseldorf VDI NACHRICHTEN  
in Germany 29 Jan 93 p 5

[Article by Juergen Salz: “Regaining Trust”]

[Text] VDI-N, Hanau, 29 Jan 93 - Because of its controversial exports to countries like Iraq, Libya, and Pakistan,

*Leybold AG, vacuum technology specialist in Hanau, has been constantly making the headlines. The company is promising to improve its record however. Suspect contracts are now being refused, and in the process Leybold is losing millions in income.*

**VDI Nachrichten:** Dr. Heidsieck, for some months now Leybold has had strict internal guidelines in place with respect to exports. Do you have a bad conscience today because of your earlier exports to Iraq, Libya, and Pakistan of dual-use goods, i.e., goods that can be used for both military and civil purposes?

**Heidsieck:** It is not a question of having a bad conscience. It is simply that we have reacted to the changed political, social, and legal conditions in place since the end of the Gulf War by changing our internal guidelines.

**VDI Nachrichten:** Just how do you describe your new company policy in practical terms?

**Heidsieck:** According to our new guidelines, we absolutely do not export when we know, or have grounds for knowing, that our products will be misused by the customer or end user for the development and production of nuclear weapons or their delivery systems.

Last year, for example, we refused to put an arc smelting furnace into operation in India, even though the project had been approved by the responsible German authorities. After receiving our government's approval, we were informed by certain U.S. sources that the products to be produced in our furnace could possibly be used for military purposes. We then made further inquiries in U.S. offices and the Atomic Energy Agency [AEA]. But no one could give us any additional information, nor was any official agency prepared to provide us with specific information.

**VDI Nachrichten:** How many million German marks [DM] in trade turnover has Leybold lost in this way?

**Heidsieck:** Calculated for the year, we easily reach a figure of tens of millions.

**VDI Nachrichten:** How do you explain to your employees the fact that you are refusing contracts, while at the same time you are eliminating many jobs and entering red figures in the books?

**Heidsieck:** It is a bitter thing to do, but necessary if we are to win back lost trust. The entire work force here is united in this.

**VDI Nachrichten:** Why do you accept such trade losses when the pertinent laws and export regulations would permit such trade?

**Heidsieck:** To protect ourselves. It was not so very long ago that Iraq was viewed very favorably by the West because a good many politicians saw Iraq as a bulwark against the spread of fundamentalism. Then the Gulf

War broke out and many companies suddenly found themselves being pilloried. The situation with Iran was just the opposite. Initially, Iran was isolated for many years, then German industrialists were being encouraged to invest there and help in reconstruction. Obviously, the approval ratings of some countries change rapidly. In order not to be left out in the cold, we consider it prudent to assume some responsibility by a policy of self-restraint.

**VDI Nachrichten:** And if you were to receive a request from Iran today...?

**Heidsieck:** ...we would refer it immediately to the Government Export Control Office. The same policy would hold for India, Libya, North Korea, Pakistan, and Syria. With some customers we have put agreements in place that would give us permission to conduct inspections on the spot to determine with certainty that our products are not being used for purposes other than those stipulated.

**VDI Nachrichten:** Customers from these sensitive countries would not always approach Leybold directly.

**Heidsieck:** That is correct, but experience to date shows that attempts to circumvent our control system are detected. We have established a staff office for export controls. Its four-member staff thoroughly checks out every contract. Nothing leaves the company without a signature of approval by the head of that control office. Incidentally, the same procedures can also be required for deliveries within Germany. We inspect each packing crate before it leaves the premises to ascertain with finality that everything therein contained is as described.

## Swiss National Effort to Advance High Technology

### Biotechnology Research

93WS0280A Geneva JOURNAL DE GENEVE  
in French 13-14 Feb 93 p 18

[Article by Turhan Boysan: "Priority to Biotechnologies"; first paragraph is JOURNAL DE GENEVE introduction]

[Text] Bioengineering and neurosciences have been allocated 50 million; a center of excellence in the two fields will be established in Zurich.

Applications for biotechnology, which together with electronics and new materials is a basic element in the future of scientific research, are among the broadest of any science. Examples include genetic engineering techniques, processes for selecting micro-organisms and cell cultures, methods to replace animal experimentation, and molecular synthesis. Biotechnology gives us a glimpse of a multitude of innovations, whether in medical diagnostics, pollution elimination, or bioenergetic materials.

Moreover, the development of biomimetic technologies is no longer pure science fiction, and such techniques will enable scientists to create artificial enzymes, biocompatible materials, or artificial organisms. Most industrialized countries have established policies, including substantial financial assistance, to support the biotech industry. The former FRG, for instance, allocated 805 million German marks [DM] at the end of the eighties, and is preparing to free up from 2 to 300 million in federal funds a year.

Switzerland's resources are modest by comparison, and have so far encouraged essentially individual projects. "Our country is lagging behind," notes the National Scientific Research Fund (FNRS), and scientists have been demanding a commitment to close the gap for several years. Now they have one, in the form of one of the six Priority Programs passed by the Federal Council. The "Biotechnology" program was launched in March 1992 and has been granted funding of 50.4 million for its first phase, which runs through 1995. Research over that period will focus on protein production, bioelectronics, the study of higher plants, and technology transfer.

Competition for the last phase has just begun: Researchers have until 29 March to file their project outlines. The first module deals with bioengineering and substance transformation, to be used to produce new components such as biocatalysts or pharmaceutical products. "Protein design" and cellular metabolism engineering—both made possible by the blinding speed at which molecular biology has developed—will enable technicians to produce components industrially, by altering micro-organisms using enzymes or transport proteins.

### Zurich Converts to Neurosciences

The last module concerns neural computing, which is a product of the interactions between neurobiology and information science. Neural computing is based on the study of how the central nervous system processes information, and aims to translate the way the CNS is organized by applying it to artificial systems.

Researchers seek to build neural architecture computers that will outperform massively parallel ones. But their links with other disciplines (biology, chemistry, genetics, immunology, or endocrinology) raise hopes that significant strides will be made in understanding the mechanisms of aging or nervous cell regeneration.

Although neural computing seems to have a bright future ahead in German-speaking Switzerland (see below), it already enjoys fertile soil near Limmat. Consequently, the University of Zurich and the EPFZ will house a new institute scheduled to open its doors in 1994.

"It will be a center of excellence open to all Swiss specialists," explains Dr. Oreste Ghisalba, the Priority Program's science director. The center will be organized into three departments: besides one for systems neurophysiology (the study of the brain and of functions such as learning and memory), there will be another focusing on theoretical approaches. Computer simulation of



neural functions and models of how artificial systems process information are meant to create new methods such as image recognition or autonomous "flexible automats."

The third department will deal with technical applications; study of the interactions between electronic components and neural structures may lead to the fabrication of biological sensors or neural prostheses. The program is counting on close collaboration between institutes and industry (pharmaceutical-chemical, microelectronics, and data-processing), something that is already well-established between Zurich and Bale.

Neural computing is more developed in the United States than in Europe, and these new resources could boost Switzerland to a dominant position on the Continent. The priority program is slated to continue until 1999, but the FNRS seems determined to move ahead at double speed: The first chair positions are already open and competition for the module has begun even before all the Zurich projects have been defined....

#### Neural Network Research

93WS0280B Geneva JOURNAL DE GENEVE  
in French 13-14 Feb 93 p 18

[Article by Nicolas Henchoz: "Artificial Neurons Proliferate at EPFL"; first paragraph is JOURNAL DE GENEVE introduction]

[Text] Neural networks are booming. The EPFL [Lausanne Federal Polytechnic] is trying to rise to the challenge by creating the Mantra Center.

First it was artificial intelligence, now it is definitely artificial neurons that are all the rage. Neural data-processing techniques should finally remedy the flaws of conventional computers, which are especially slow at recognizing objects or making decisions automatically. The trick? Unlike traditional computers which have a very powerful central chip, neural machines combine a large number of computing units that perform only extremely simple operations. Most important, the units communicate among themselves very rapidly, and together form a network with surprising capabilities. This principle enables neural machines to acquire experience. In other words, the more they work, the more effective they become at solving a particular type of problem. The technology is proving especially adept at very rapidly solving tasks that involve a large number of parameters, but that require neither logic nor very precise results.

The prospects are sparking a craze for neural networks among scientists. In the United States it is estimated that the DARPA project, which aims to organize American research in the field, involves about 200 universities and a budget of \$400 million.

Switzerland is also jumping on the bandwagon. And the French-speaking Swiss did not wait for the National

Fund to create a "center of excellence" in Zurich. The Carnac [Advanced Collaboration on Neural Networks and Cellular Automats] group has been bringing together over 150 French-Swiss researchers and manufacturers, drawn from various fields, for four years. And Carnac has produced some very concrete projects: The Mantra project has designed a neural machine that can monitor an electrical network.

#### Other Developments

Shored up by this success and by other studies underway, the EPFL decided to create the Mantra Center. A total of 20 people are teaming up on the new institute. It is being financed by the EPFL, which is Switzerland's national priority program in data-processing and industry, for about 1 million French francs [Fr].

The brand new center in Lausanne has other developments besides the Mantra project on its agenda, notably a system to help the Swiss Institute of Meteorology analyze weather near airports. The scientists are also working on an industrial application with Landis and Gyr to recognize bank bills.

EPFL researchers have thus decided to pursue very concrete, short-term (about two years) projects to define and try to solve the great theoretical problems of this new information technology. It is an original approach in neural network research, which aims to give the center a chance to compete with other, much better financially endowed institutions....

#### Professor Sees German Basic Research in Danger

93WS0281A Frankfurt/Main FRANKFURTER  
ALLGEMEINE in German 10 Feb 93 p N3

[Article by Prof. Walter Greiner, professor of theoretical physics at the University of Frankfurt am Main: "Basic Research in Physics Under Pressure: Federal Research Ministry Hinders Access to Major Equipment; Less Funding"]

[Text] Overfilled lecture halls with several hundred students and a lone professor at the lectern—these images are ubiquitous. Can people still get a proper education in the natural sciences under such circumstances? Joint research between colleges and major research facilities has made that possible in important areas. It has given college instructors, together with their undergrad and grad students, the opportunity to search for the new and unknown at central installations—accelerators, radiotelescopes, and other equipment. Last year, former Minister for Research and Technology Heinz Riesenhuber made drastic cuts in support for this joint research. In this way he has hindered research and education.

Indeed, academic training in the natural sciences requires more than (mass) lectures during the first four

to six semesters. Although numerous seminars and practical courses introduce students to the elements of scientific work, real academic training begins only with "inquiry-learning." Unfortunately, to this day the public has not given the necessary attention to this second, more important pillar of learning through research. It is precisely this type of learning, training in the second segment of study that is closely linked to research, that is jeopardized by the cuts in joint research at German colleges.

### Popular Natural Sciences

The precondition for the thorough yet broad training of our students is the preservation of top research at German colleges. If it is no longer possible to engage in current, inspiring research there, then the interest of future generations in research will wane. This could bring to us a trend like the one in the United States. There, students aspire to service professions; they become bankers, stock brokers, or lawyers. But the "hard sciences" are avoided. For years now, more than half of the open positions in research at many universities and research centers have been given to foreigners! It is not unusual for most of the (few!) students, even at the best colleges, to come from India, China, and Arabia.

In contrast, our universities are bursting at the seams. However, there is not enough space, money, and staff to admit and appropriately educate the many good students. Active professors strive to find the funding necessary for research by endlessly writing proposals. However, the Hessian Land government apparently likes the poor trend at its colleges so much that as part of its so-called "structural plan" it is eliminating a total of eight professorships in the field of physics at the University of Frankfurt and also thinning out the nonprofessorial teaching staff. Other fields and colleges are similarly hard-hit. Even renowned institutes are not being spared! In this difficult situation, the Federal Ministry for Research and Technology [BMFT] has cut the funding for cooperative projects between colleges and major research facilities in heavy-ion physics, medium-energy physics, and particle physics by 30 percent. And they say that the funding for these disciplines will have to be reduced even further.

Because of the principle of the unity of research and teaching, German universities were considered international models and copied by many countries. The unity of research and teaching at our colleges is an essential pillar of our industry. Only on the front line of research by active college instructors is it possible to impart to students the latest findings and especially the enthusiasm that gets young researchers on their way and furthers their creative strengths. In the future, therefore, research at German universities must maintain an equal position next to teaching.

The course taken by the BMFT contradicts these principles. Thus, a December 1992 report stated that "in the future efficient basic research can receive the financial

support given in the past only if intensified efforts are made to convert the knowledge into industrial products. This requires a close and continuous exchange of ideas between industry and basic research, like the successful case of the chemical industry research fund, for example." This type of "basic research," which amounts to applied research or development, will run dry very soon, because the necessary new findings are lacking. In addition, basic research cannot simply be turned off and then on again. It takes 10 years or longer to develop a good group of researchers. Thus, funding must be long-term and reliable.

### Proven Cooperation

Ultimately, basic research costs money. In many disciplines, but especially physics, machinery—so-called "major equipment" such as particle accelerators, radiotelescopes, or neutron sources—is necessary that individual colleges can no longer afford. This led to joint research in the early 1970s: By jointly using a central installation, colleges are still able to engage in top research. The Desy Laboratory in Hamburg, the Association for Heavy-Ion Research (GSI) in Darmstadt, the radiotelescope in Effelsberg/Eifel, the European south star observation station in Chile, the Meteor research ship, and the Cern European high-energy center in Geneva are examples of such facilities. In this way, and only in this way, top-class training is guaranteed. Through this program, launched nearly 25 years ago, Germany has retaken ground internationally, in the fields of heavy-ion and particle physics, for example.

The funding that the federal government has bestowed on colleges in heavy-ion and particle physics through joint research is shrinking. For three years, for example, all German colleges had an annual amount of 109 million German marks [DM] available for research in heavy-ion and particle physics. This money was distributed by an expert committee. This support saved the scientific lives of the best groups. Because of the sudden, unannounced cut in this funding (by nearly one-third), most college teams are seriously hindered; a good many of them have had to halt their work entirely; funding for young scientists (postdocs) is worsening; many have had to discontinue their work and education. Numerous gifted students who are enthusiastic about this basic research are left out in the cold; the waiting line is growing, and study time is becoming longer through no fault of the students. But that is not all: Now there is the danger that our laboriously regained international position will again be lost. We know from our own tragic experience how quickly that can happen.

The BMFT intends to turn funding for college research over to the Laender entirely. Given the poor financial situation in all the Bundeslaender, this will have fatal consequences for joint research. Lurking behind this trend is the intention to restrict expensive high-energy physics in general. (Cheaper) nuclear physics is being

thrown in as well. There is neither a high-energy nor a nuclear physicist on the advisory board to the BMFT, the Grossmann Committee.

Everyone recognizes now that ultimately, and with regard to the reunification of our country, funding restrictions are necessary. Where should we get the money needed to ensure some degree of continuity, especially if important new areas such as the life sciences also demand their share?

Naturally, the high costs of major research centers are conspicuous. Representative of this problem is CERN, which threatens to gobble up almost everything, like a black hole. Nevertheless, some of the money from the relatively modest heavy-ion joint research (around DM10 million a year has already been cut here) is supposed to go to Geneva. A lead injector is needed there that will cost the Federal Republic of Germany an additional DM7 million. Disregarding the expert committee for joint research, the BMFT promised to divert this money from the funding intended for the universities. Supposedly, the necessary funding cannot be found in the gigantic CERN budget, with an annual German contribution of around DM250 million and an annual growth rate of around 10 percent. Thus, CERN is cashing in at the expense of German colleges.

#### Unequal Earnings

The universities are bleeding, and the CERN budget gets bigger and bigger. At the same time, salaries are paid there that are 50 percent (and more) higher than researcher salaries at colleges and German research facilities. In this way, the German (national) institutes are not only devalued, but also declared inherently second-class. With a personnel budget of around 470 million Swiss francs [SFr] a year, many millions could be saved and used for necessary expansions, such as the lead injector and other equipment. A 20 percent cut in the tax-free salaries and their alignment with standard earnings all over Europe would yield more than DM100 million a year. Recently, at least, the CERN board decided not to compensate completely for the increase in the cost of living when fixing salaries. Research in the natural sciences at European colleges would be helped to an extraordinary extent by such financial support. At the same time, research at CERN would be reformed.

Basic research has always been a cultural asset in Europe, and one that even paid off economically over the course of decades. Europe can be proud of this tradition; it must be handled gently and cared for appropriately. That would be good research policy—in Germany as well!

#### France: Industry Gets Advanced Materials Aid

93WS0290D Paris COMPOSITES ET NOUVEAUX MATERIAUX in French 1 Feb 93 pp 1, 2

[Text] The polymer and composites department of CETIM (Machine Industries Technical Center) will help any company that wishes to incorporate new materials

into its products to become more competitive. Its Nantes "Design Assistance" department will design the materials and forming techniques a manufacturer needs to boost its competitiveness, or even to switch from its traditional business to a more productive one, starting from a specifications sheet. Prototypes and preproduction samples can also be fabricated. "The manufacturers that call on us most often are small and medium businesses whose research funding is very limited or even nil," says Alain Dessarthe, the head of the "design assistance" section of the polymer and composites department. In contrast, CETIM works more as a partner with big industrial groups. "We collaborate with their own research centers and only get involved occasionally on one part of a study," insists Alain Dessarthe. Two recent examples of CETIM's development work for manufacturers include scalar panels and hot water balloons made of composites.

The center rounds out its services with studies of general interest. Because CETIM embraces 6,000 manufacturers, it is subsidized by excise taxes that allow it to initiate, among other things, more basic studies "on the test-tube level." The Nantes shop has various kinds of equipment with which to provide its services, including a compression press (SME or TRE), an injection press, a fiber-winding machine (resin-impregnated or plastic fibers), and low-pressure RTM and stratification equipment. It also offers two new publications to assist in design and implementation: a guide on assembling plastic, composite, or sandwich parts, and a report entitled "Polytetrafluoroethylene, Presentation and Application." A software package is available for computing and dimensioning glued joints. It can be installed on IBM PC-compatible desktops.

#### CETIM's Intensive Work in Non-Destructive Defect Inspection

CETIM offers another service—non-destructive defect inspection—at its Senlis site. CETIM's NDDI department has been using an acoustical emissions technique to certify and characterize the time behavior of glass-fiber-reinforced plastic materials for three months. Oil industry manufacturers are particularly interested in it, and use the "Carp code" procedure to characterize their epoxy-resin and glass-fiber tubes and award them the ASTM standard.

The "Carp code" relies on a technique of acoustical emission inspection that generates a signal for each flaw detected in the material. It subjects the tubes to sequences of increasing pressures, and monitors them simultaneously via sensors that pick up the transient stress waves produced by the flaws under pressure. Several criteria can be used to differentiate the type of damage, whether it be resin cracking, breaks in fiber-matrix interfaces, fiber stripping, fiber breakage, delamination, or the rupture of glued joints.

CETIM's recently launched Creative project is based on the same technology and seeks to assess the material's

condition during aging rather than at the instant of inspection. The center's partners on the project include Elf Aquitaine, SPBI, and, soon, Electricity of France. "The project is open-ended; other partners can join and reorient or round out the studies to produce results that are more specific to their industry," insists Mr. Cherfaoui, the head of the Senlis NDDI section. "Research on the Carp code produced an ASTM E 188 standard, and we want to do the same with the Creative project," he also stresses.

Inspection of materials has become mandatory, but it is still a lengthy and expensive process. To reduce the time and cost involved, CETIM is offering manufacturers a tube-testing platform located at Senlis. "We would like to shorten the procedure by reducing the materials characterization step from 18 to six—or even three—months."

The Carp procedure has already had the bugs worked out and is available to any manufacturer that wants to characterize its material. When flaws are apparent, CETIM can advise the manufacturer on how to select or form its material.

CETIM, 52 avenue Felix Louat, BP 67, 60304 Senlis Cedex, Tel: 44 58 32 66.

### **German Research Ministry Launches Surface, Coating Technologies Program**

93MI0315 Bonn *TECHNOLOGIE-NACHRICHTEN*  
*MANAGEMENT-INFORMATIONEN in German*  
15 Jan 93 pp 2-3

[Text] Surface and coating technologies are key technologies of the future owing to their wide range of applications. German firms have a 12-percent share of the world market for coated products and a 12-percent share for surface and coating technology systems, so they are well-placed in the competition for the rapidly growing demand for coated products and surface and coating technology systems. However, they will survive in this global competition only if they make an even greater effort, particularly as regards developing and applying modern surface and coating technology processes.

For this reason, the BMFT [Federal Ministry of Research and Technology], building on the experience acquired with the former Thin Film Technologies funding program, has decided on an extension intended to maximize the dissemination of these technologies in industry, both in scientific and technical circles and through the requisite information transfer to companies. The BMFT is providing 150 million German marks [DM] for this purpose between 1993 and 1996.

The reason why the surfaces of technical products are accounting for an increasing share of their value, currently estimated at 5-15 [percent] of product value, lies largely in the superior technical properties of modern coating systems, which are applied mainly by plasma, ion beam, and vacuum-assisted processes. Surfaces with

specific optical, thermal, chemical, and mechanical properties can thus be tailored for the particular applications required.

In the first phase of the program, basic research in surface analysis, coating, and process development received BMFT funding totaling DM134.9 million. Just half the funding went to universities, around 20 percent to nonuniversity research institutes, and 31 percent to firms, which themselves spent DM55.6 million on developing these technologies.

The funding has led to a thorough understanding of basic coating structure, including the *in situ* analysis required for optimum process control. Process developments focused mainly on the PVD (physical vapor deposition), CVD (chemical vapor deposition), and plasma treatment processes, the emphasis being on the development of corrosion- and wear-reducing coatings. A highly promising new field was also explored: the process for applying thin crystalline diamond coatings, whose extremely high heat conductivity and special optical and electrical properties are arousing great interest. For example, they can be used to coat tools, giving them excellent protection against corrosion and wear even at high operating temperatures. The scope of their potential is shown by the fact that, in Germany, only 1 percent of tool and machine components that would benefit from coating are in fact coated.

Building on the findings and experience acquired in the first phase of funding, the second phase, now starting, is intended to create the conditions in which surface and coating technologies can be applied in the following key technical areas:

- coatings for low-wear manufacturing;
- application of coatings to large glass and metal substrate surfaces, and
- functional coatings for ceramics and plastics.

The intention is to enable small and medium-sized enterprises in particular to improve the quality of their products, particularly in mechanical engineering and aircraft industries and the glass, plastics and ceramics industries, thus substantially enhancing their competitiveness in the international market-place.

To this end, the new funding program addresses the scientific, technical, and nontechnical shortcomings that are at present inhibiting large-scale industrial application of these processes. On the technical side, there are problems with upscaling the processes, with three-dimensional coating, with lowering the coating temperature, and with process control.

Nontechnical shortcomings such as inadequate knowledge among small and medium-sized enterprises of the potential held out by these processes, high investment costs for new users, extensive in-house R&D requirement, and the difficulty of evaluating future market



developments also inhibit the spread of these technologies in industry. Innovation is further hindered by the prevalence of medium-sized enterprises on the supplier and user markets.

The mechanical engineering, aircraft, glass, plastics, and ceramics industries targeted are not only major areas of application for modern coating processes; their efficiency and success are also crucial factors in Germany's international competitiveness. Preference in allocating funding will be given to joint projects that will contribute to eliminating the aforementioned scientific and technical shortcomings through research and development arising out of specific applications.

Depending how close their work comes to practical applications, grant holders may receive from 40 to a maximum of 50 percent of the subsidizable costs incurred while carrying out a project; for applicants from the new laender, grants are 10 percent higher. Around 70 percent of funds are earmarked for small and medium-sized enterprises, while 25 percent are intended for the requisite collaboration with research institutes. Large firms will receive grants only in exceptional cases. Applications for around DM30 million are expected from applicants in the new laender, who show considerable potential, particularly in research institutes.

Lack of information, for example on the state-of-the-art, new application potential, or the assessment of technical risk, continues to be a major obstacle to the future development and spread of surface and coating technologies in Germany. The funding program addresses this issue through the following measures, some of which either form a direct part of the joint projects funded, while others are funded as separate projects:

- dissemination of information;
- support for standardization to keep pace with development;
- creation of databases;
- brief studies to be drawn up on major issues;
- creation of information centers.

These funding projects are, once again, primarily intended to assist small and medium-sized enterprises; they will be implemented by bodies such as trade associations, scientific institutes, the German Standards Institute (DIN), and other bodies working with medium-sized firms.

#### **Italy: Microelectronics Development Associations Established**

93MI0342 *Genoa GE.RI.CO. NEWS in Italian Jan 93*  
pp 7-10

[Text]

#### **The Establishment of the MIDA Association**

The Association for the Development of Microelectronics in Italy has been established in Genoa. The name of the association is MIDA, an acronym from English that

stands for Microelectronics Development Association. Two of the four founding members are in fact multinational companies, SGS-Thomson Microelectronics and ES2.

The goal of the association is to further the exchange of information, know-how, tools, and resources in order to promote industrial projects, technology transfer, and applied research in the numerous fields of microelectronics. This should lead to the establishment of a national microelectronics center similar to those already in existence in the more advanced European countries such as IMEC [Interuniversity Microelectronics Center] in Belgium and CMP in France.

There is currently a need for increased coordination of resources and expertise in the microelectronics sector in order to favor more effective industrial application of this technology, especially among small and medium-sized industries.

It is with this objective that the Genoa Research Consortium is promoting the initiative by using the experience and know-how present in Genoa, a city with a university that has the most longstanding tradition of microelectronics research in Italy.

The four founders of MIDA are: SGS-Thomson Microelectronics, an international semiconductor manufacturer with branches in Europe, the United States, and Asia; European Silicon Structures (ES2), a Silicon Engineering company with operational centers in France and the United States; the Genoa Research Consortium which, in cooperation with the Department of Biophysical and Electronic Engineering, works with other European systems industries and research centers; Tecnopolis CSATA, Italy's first science park with a workforce of 500.

Genoa Research Director General Paolo Marengo, a 40-year-old electronics engineer has been elected president of MIDA.

MIDA is a nonprofit organization and is open to membership from other organizations, companies, and universities having an interest in its strategic objectives.

Given the strategic importance of the microelectronics sector during the 1990s, this issue of GE.RI.CO. NEWS contains a special insert on microelectronics projects, players, and initiatives.

#### **Profile of MIDA Founding Members**

##### **Genoa Research**

The Genoa Research Consortium, which was established in 1986, is the first City Research Consortium in Italy to be promoted by IRI [Institute for the Reconstruction of Industry], the CNR [National Research Consortium], Unioncamere [Association of Italian Chambers of Commerce], universities, and industries in the principal Italian cities.

Genoa Research has carried out numerous projects by bringing together university and industrial expertise in new sectors such as advanced transport systems, multimedia systems, ground information systems (GIS), and microelectronics. In this last area, Genoa Research established a center for the design of VLSI (very large-scale integration) circuits in 1987. The center, which availed itself of the longstanding tradition of microelectronics research and training at the University of Genoa Department of Biophysical and Electronics Engineering, has obtained important achievements both in basic and applied research projects and national and international support since the late 1970s.

In particular Genoa Research participated with the Department of Biophysical and Electronics Engineering in an EC Special Action project for microelectronics in Italy called I-SMILE [Microelectronics Support for Interaction between Employment and Education in Italy]. Within this framework, ASIC [applications-specific integrated circuit] projects were developed for national industries such as Esaote Biomedica.

#### **Tecnopolis**

Tecnopolis Novus Ortus is the first Italian science park and was established in Valenzano near Bari in 1984. Promoted by the Ministry for Special Intervention in Southern Italy, Tecnopolis has acquired expertise and set up technological laboratories in the sectors of information, communication, and microelectronics that are designed to support and disseminate innovation in the South and are now exchanged in international programs. The Tecnopolis staff of more than 500 includes researchers, technicians, university professors working on programs for companies such as Olivetti, Fiat, Telettra, Finsiel, and IBM.

The center for microelectronics applications has been operating at Tecnopolis since the establishment of the science park and is currently one of the principal Italian centers of technology transfer working in this area. Tecnopolis has been directing the EC Special Action project I-SMILE since 1992, and within this context has worked on applied microelectronics projects with local companies and has organized training courses for the dissemination of microelectronics. The center focuses on breakdown detection, type testing, and the certification of electronic components.

Tecnopolis is also working on an EC 1993 Special Action project for Italy called Microelectronics for Small and Medium-Sized Industries. The goal of the project is to promote information, awareness, training, and the development of industrial projects among small and medium-sized industries working on the advancement of microelectronics technologies.

#### **European Silicon Structures**

ES2 was established in 1985. The ES2 plant, which is located in southern France (Aix-en-Provence), focuses

exclusively on the production of custom silicon and thereby makes its advantages accessible to all systems manufacturers.

ES2 shareholders include: Siemens, British Aerospace, Philips, Olivetti, Bull, Aerospatiale, Telefonica, Telfin, Saab-Scania, and Asea-Brown Boveri.

In 1992 ES2 produced its 2500th chip and confirmed itself the leading European manufacturer of cell-based ASICs. ES2 is acquiring the features of a Silicon Engineering company that can guarantee:

- short-term prototype development;
- a prototyping service without any need for the client's participation in the manufacturing process;
- products conforming to CECC [European Communal Credit Community] and MIL-STD-883C regulations, and for the aerospace sector, to ESA/SCC regulations;
- special products such as silicon substrate hybrids or silicon sensors.

ES2 has adopted the E-beam direct printing on silicon method without resorting to masks. This system reduces the production times and costs of prototypes and improves quality.

The ES2 Solo 1400 development system is supported on the principal SUN, HP, and DEC platforms and is also integrated with the Mentor Graphics CAE environment.

ES2 attributes particular importance to joint efforts with universities and technology transfer centers. In Italy 17 universities have ES2 ASIC development systems.

#### **SGS-Thomson**

The SGS-Thomson Microelectronics group, an international semiconductor manufacturer, was established in 1987 following the merger of two European companies SGS Microelectronics [in Italy] and the French Thomson Semiconductors, each with over 30 years experience in the sector. In April 1989 SGS-Thomson further strengthened its position on the international market with the takeover of the British company Inmos with its particularly advanced product portfolio in the field of MOS [metal oxide semiconductor] microelectronics technologies.

All the SGS-Thomson group companies are controlled by SGS-Thomson Microelectronics NV, which is controlled through a financial holding company by IRI [Institute for the Reconstruction of Industry]/Finmeccanica (45 percent) for Italy and Thomson-CSF (45 percent) for France. The remaining 10 percent is held by the British group Thorn-EMI, the previous owner of Inmos.

SGS-Thomson has acquired a leading position in the worldwide semiconductor market thanks to its technological know-how, the competitiveness of its resources, and a range of products that cover all the applications of

the present-day electronics industry. In 1991, with revenues in the vicinity of \$1.5 million SGS-Thomson ranked second among the European manufacturers and 13th in the world.

The group has a workforce of 17,000, eight R&D units, 25 design centers, 16 plants, 44 sales offices in 21 countries and over 600 distributors and representatives throughout the world.

SGS-Thomson Microelectronics managing director is Pasquale Pistorio. The head offices are located in Agrate Brianza (Milan) and Gentilly (Paris).

Its head operations office in the United States is located in Carrollton (Dallas, Texas) while the group's general headquarters for the Asia and Pacific region are in Singapore and for Japan in Tokyo.

In order to guarantee continued technological development and offer clients leading-edge products SGS-Thomson invests approximately 20 percent of its revenues in R&D activities each year as well as playing a key role in advanced European research projects.

SGS-Thomson is recognized as being the undisputed world leader in the rapidly growing sector of smart power, or intelligent power circuits. In this area its innovative skill is combining signals and power on the same chip has opened up new fields of application. The company is number one in the world in the sector of integrated power circuits such as audio amplifiers (for which it has almost sold its billionth circuit) and engine control circuits. The company is also recognized as being one of the world leaders in discrete power circuits, especially in sectors such as power transistors, diodes, and silicon-controlled rectifiers.

SGS-Thomson has a wide range of digital devices, including microprocessors, EPROM [erasable program-mable read-only memory] and EEPROM [electrically-erasable programmable read-only memory] memories, Flash and RAM [random access memory] high density static memories, sophisticated dedicated circuits, circuits for image compression and graphic processors.

In the area of EPROM memories, the SGS-Thomson portfolio of products ranges from small density to 16 Mbit devices. According to Dataquest, the company ranks third in the world and first in Europe in this field. The market penetration for these leading-edge products reached 13 percent of the world market and 6.6 percent of the Japanese market in the second quarter of 1992.

With a wide range of digital, analog, and digital-analog semicustom devices (standard cells, sea-of-gates, and gate arrays) based on advanced CMOS [complementary metal-oxide semiconductor], BiCMOS [bipolar complementary metal-oxide semiconductor] and bipolar technology, the company ranks among the leading suppliers of semicustom integrated circuits.

This ranking has been further strengthened with the developments of an exclusive triple metallization 0.7 micron CMOS technology.

Moreover, following the Inmos takeover, SGS-Thomson has gained access into the highest levels of the 32-bit microprocessor market with the transputer, an extremely advanced device that is particularly suited for parallel applications.

### **Italian Research Insititute Assigned EC Microelectronics Program**

*93MI0343 Genoa GE.RI.CO. NEWS in Italian Jan 93 pp 10-11*

[Text] ENEA [Agency for New Technologies Energy, and the Environment] has been designated by the Ministry for Universities and Scientific Research as the coordinator of an EC Special Action program for Italy. This program is designed to further the development and diffusion of basic microelectronics technologies among small and medium-sized industries and to promote the establishment of facilities for the design and testing of integrated circuits.

In addition to ENEA, which has been allocated three quarters of the overall funding, the Tecnopolis Csata [science park] in Bari, which has received the remaining funds, will also participate in the project.

The Special Action is part of the ESPRIT [European Strategic Program for Research and Development in Information Technologies] program. It has been allocated ECU8 million in funding and will last 36 months. Initially only half this amount will be allocated over an 18-month period. Since the EC allocates funding on the condition that the same amount will be mobilized, the total sum of money to be made available amounts to ECU16 million (approximately 27 billion lire).

The initiatives the EC intends to undertake among small and medium-sized industries for the advancement of microelectronics technologies involve information, awareness, training, optimizing results, and technological and financial support.

The last initiative in particular comprises two different lines of action:

- 50 percent technological and financial support for approximately 15 new projects;
- 50 percent technological and financial support for the establishment of Microelectronics Centers (CCM) that can provide highly-qualified services in the field of microelectronics to small and medium-sized industries. The CCMs will have to be run efficiently and must become independent once the start-up phase is completed.

The Special Action program focuses on the following technologies:

- the integration of CMOS [complementary metal-oxide semiconductor] nonvolatile memories (EPROM and EEPROM);
- intelligent power circuits;
- intelligent sensors;
- CMOS and BiCMOS [bipolar complementary metal-oxide semiconductor] circuits.

These technologies are considered of great importance for the development of various mass consumer products by small and medium-sized industries such as credit cards, special access cards, identification systems, personalized apparatus, laboratory systems for use in medical diagnostics, instrument calibration, and engine control etc.

Invitations for participation by industries will be published in the leading newspapers, specialized and general interest publications, and through the channels used by industrial associations.

A call for demonstrators and the establishment of microelectronics centers will be subsequently published.

The demonstrators and CCMs that will receive funding will be selected from the applications submitted by industries and the selection conducted by a commission of experts in accordance with EC guidelines and regulations.

An advisory board, composed of representatives from the Ministry of Universities and Research, the Ministry of Industry, the EC, academic and scientific institutes, and industrial associations, will assist ENEA and Tecnopolis experts in managing the initiative. ENEA will also avail itself of the expertise of the CNR [National Research Council] within the framework of a special agreement.

Contact point:

Dr. Luigi Lesca ENEA Viale Ercolani 8 40138 Bologna  
Tel: 0039 51 498378 Fax: 0039 51 498255

Dr. Bruno Bonati Tecnopolis Novus Ortus 70010  
Valenzano (Bari) Tel: 0039 80 8770346 Fax: 0039 80 6951868

### **Record of German Research Under Outgoing Minister Discussed**

93MI0352 Bonn *TECHNOLOGIE-NACHRICHTEN*  
*MANAGEMENT-INFORMATIONEN in German*  
28 Jan 93

[Text] Heinz Riesenhuber's resignation as research minister was not surprising, stated Josef Vosen, research spokesman for the parliamentary SDP [Social Democrat] party. He claimed that Riesenhuber, who for 10 years had shown enormous commitment to research, was regarded in specialist scientific and industrial circles as a spent force. A particular criticism was that Riesenhuber had always lacked the power base needed to obtain the necessary funding for the BMFT [Federal Ministry of

Research and Technology], which for years had seen its budget plundered to keep the overall federal budget on its feet.

Below-average growth rates had bled many research projects white; in particular, the budget was inadequate to cover the scale of research required in the new laender. Research funding for medium-sized enterprises had also been heavily cut.

Research Minister Heinz Riesenhuber's departure has prompted a critical appraisal by the parliamentary social democrat party of the last 10 years of German research policy. According to Vosen, Riesenhuber's greatest achievement had indisputably been the strengthening of basic research in Germany, though this had been accomplished at the cost of other sectors, such as non-nuclear energy research and support for medium-sized enterprises. The strategic error at the end of the eighties of devoting insufficient attention to microelectronics had resulted in reduced German industrial competitiveness on the world market, a situation drastically aggravated by German unification. Over the past three years, German research had suffered a decline that it would be virtually impossible to make up. In Vosen's view, these two facts meant that, overall, Riesenhuber's term of office had had a negative effect. The SPD criticizes the following individual aspects:

Undoubtedly, Heinz Riesenhuber brought expertise to bear in individual cases. However, his love of major projects, such as the space program, together with his pronounced faith in technology, led to numerous mistakes over major projects, such as the fast breeder reactor or the Hermes space plane. In major areas of high technology, such as microelectronics, Germany has lost ground to Japan and the United States, a process that Heinz Riesenhuber was unable to halt or reverse.

Since unification, the research budget has been short by a billion German marks [DM] per year, i.e., by the equivalent of the additional research costs incurred in the new laender. Only at the end of the third year following unification will the research budget for the united Germany, at DM9.3 billion, return to a level nominally equivalent to the combined eastern and western budgets for 1989. This means that within three years the sum formerly allocated to the eastern research budget has practically disappeared. This is the depressing concrete result of the running down of research in the East. The chairman of the Science Council, Professor Heinz Simon, whose assessments provided the groundwork for the political decision-makers, now bitterly observes that these are "bad times for science policy in the united Germany."

The competitiveness of German industry, particularly the information technology sector, has declined on a worldwide scale since 1983, and particularly compared with Japan. Firstly, since 1984 the proportion of the total budget spent on research has fallen from 2.7 to 2.2

percent. Secondly, the proportion of research expenditure allocated to basic research has increased from around 28 to over 40 percent. The BMFT was created for other reasons, specifically competitiveness in key technologies. Thirdly, the proportion of the research budget spent on contributions to international programs—i.e., space flight—has risen from 10 to 18 percent. Each of these shifts involved billions of German marks in absolute figures.

These statistics represent a remarkable decline in the strategically important funding of industrial applications in key technologies, with the result that whole sectors have fallen away over this period, allowing the Japanese lead in microelectronics to develop into a threat to our major industries: engineering, automobiles, and telecommunications.

Over 10 years, the proportion of the gross national product (GNP) spent on research and development has also suffered a relative decline in global terms. For a long time we had kept pace with the United States and Japan, spending around 2.7-2.8 percent of GNP, but for years now we have been stuck at 2.8 while Japan's figure has risen to over 3 percent.

This means that for the past 10 years the advance from basic research to industrial application has been hindered. The transition to environment-friendly power industry through effective research programs has not been made.

Compared with the final year of the social democratic-liberal government, the past 10 years have seen a complete change in the non-nuclear energy research funding structure. Expenditure for this sector was DM704 million (10.1 percent) in 1982, compared with DM456 million (4.8 percent) in 1992.

While a total of over DM30 billion has been spent by federal governments on nuclear energy research and development, this government has not only failed to support the increase that had begun in non-nuclear energy research, but has slowly but surely reduced it. The cumulative effect has been that, over the years, this government has reduced environment-friendly energy research by over D3 billion, at a time when the need for research, both worldwide and in this country, has been increasing.

Riesenhuber was responsible for the excessive delay in discontinuing three projects: the Hamm THTR [thorium high temperature reactor], the SNR [fast sodium reactor] in Kalkar, and the Wackersdorf reprocessing plant. This may have cost DM3 billion, or more, during his term of office.

Funding for small and medium-sized enterprises has been drastically reduced. Technology policy is criminally neglecting small and medium-sized enterprises, which are a decisive feature of the west German economy. Firms with fewer than 500 employees and annual revenue below DM100 million employ 67 percent of the

workforce, produce 50 percent of our national product, and provide 80 percent of our young people's professional training. The federal government has drastically cut research funding for small and medium-sized enterprises in the original federal laender. The particularly effective program of personnel cost subsidies for funding for small and medium-sized enterprises in the original federal laender, as have funding for technology-oriented company start-ups and innovation funding for small and medium-sized enterprises. At the same time, investment bonuses and special depreciation facilities for R&D investment have been abolished.

The Federal Association of German Industry (BDI) has described the federal government's overall strategy for small and medium-sized enterprises in 1989 as all wrap-up and no content.

Too large a proportion has been allocated to the space budget and its projects. When Heinz Riesenhuber took office in 1982, the proportion of the total budget allocated to space expenditure was around 11 percent; by last year this had risen to 19 percent, despite the fact that the operating conditions for overall European and German space policy had changed completely since the European Space Agency (ESA) adopted its long-term plan in The Hague in November 1987. In particular, the end to the East-West conflict has meant that competition between the two systems has lost its importance as a driving force in space activities. International cooperation is now the hallmark of the new era. This must necessarily take the form of global space policy cooperation.

This should begin with serious cooperation with Russia (CIS), which has the largest space capability in the emergent Europe. The initiatives taken so far are not sufficient.

The major research establishments have been largely left to choose their own topics. The BMFT has put all the major research establishments on a uniform slimming diet taking no account of each one's research content and areas of emphasis. According to plans, this will lead to uniform cutbacks, which over the next few years will obviously cause massive personnel reductions in the major research establishments, which have thus not been given reliable prospects; their resources have merely been depleted to solve the problem of financing the research budget.

The following consequences of Heinz Riesenhuber's policies are also worth mentioning:

- The policy of humanizing working life has been totally abandoned;
- As regards chemical R&D in research institutes and industrial laboratories, R&D in the trailblazing genetic engineering sector has been made considerably more difficult, if not prevented altogether, by the enormous bureaucratic and administrative constraints imposed by the Law on Genetic Engineering, which took effect in the middle of 1990. The chemical



industry has publicly stated that under current conditions it cannot commercially justify investing in genetic engineering research, development, and production;

- The parliamentary technology impact assessment that had been demanded has been downgraded to an item on the research committee's agenda;
- No dialog on research policy has been initiated.

The major quality required by Matthias Wissmann will be the assertiveness to succeed in procuring the funds required for German research.

### German Research Minister Makes Case for R&D Promotion

93MI0370 Munich SUEDEDEUTSCHE ZEITUNG  
in German 23 Feb 93 pp 27-28

[Article by Norbert Sturm: "Wissmann Wants Incentives To Get Sluggish Research Moving Again: 200 Million German Marks [DM] Released for East German Industry"—First paragraph is SUEDEDEUTSCHE ZEITUNG introduction]

[Text] Federal Research Minister Matthias Wissman (CDU [Christian Democratic Union]) described the fact that German research expenditure is stagnating and in some cases even declining as a cause for alarm. It was counterproductive. Expenditure on development projects ought to increase in a recession, not be cut back procyclically, the politician stressed in an interview with SUEDEDEUTSCHE ZEITUNG. He will therefore be giving it a fresh impetus by improving the regulatory framework, cutting red tape, and decentralizing large-scale research. In addition, in eastern Germany research companies will help to prevent innovative potential being lost with the collapse of old structures. Subsidies will also be increased.

Matthias Wissmann, who recently took over as research minister from his party colleague Heinz Riesenhuber, who had held the post for 10 years, wants to extend his ministry's narrow financial room for manoeuvre by repackaging measures and setting new priorities. He regards himself as a moderator and coordinator rather than the driving force of German development projects. It was impossible for the federal research minister to take industry's place, he told SUEDEDEUTSCHE ZEITUNG. His aim was to convince a broader public of the necessity for more research. Wissmann wants to back this up with better regulatory conditions, such as tax incentives that could be financed by downgrading depreciation on buildings. "It is better to invest in heads than in concrete."

Economic survival being impossible without such provision for the future, Wissmann wants to prevent inventive potential being lost in eastern Germany with the collapse of the old sclerotic structures. He plans so-called research companies that will employ redundant engineers and scientists for a certain transitional period. Wissmann has

also managed to increase subsidies for eastern German research projects, albeit at the cost of drastic savings elsewhere.

Wissmann has had to use some of his DM9.6 billion research budget to finance the solidarity pact. He put the spending cut demanded of him in the 1993 budget at DM265 million. But despite this restriction he had been able to "release" a total of DM200 million for industrial research in eastern Germany. This year this amount will be paid in addition to the DM1.75 billion already earmarked for eastern Germany in the 1993 budget. The amount will rise still further in the future, Wissmann added. Most of the "released money" will go to the chemical industry and to environmental research in Halle.

However, there seems to be a degree of phobia about research promotion. Wissmann stresses that many eastern German firms are wary of applying for subsidies. A lot of programs have not been fully utilized because those who ought to benefit from them are deterred by bureaucracy. The new research minister wants to change this by streamlining approval procedures and cutting back on form-filling. This is intended to encourage small and medium-sized firms, considered especially innovative and entitled to some DM550 million from the research budget, to undertake new development projects.

### Promoting Small and Medium-Sized Businesses

So while small firms benefit ("small is beautiful"), the large research institutes must adjust to leaner times. While Wissmann wants to retain basic research on the same scale as before, he wants to use incentives to ensure that knowledge is turned into products more quickly than in the past. This was a problem in Germany [he said]. Wissmann would also like to check programs for their efficiency. This would involve giving a lot of projects the ax, the politician said. There was, for example, little point in supporting an analog technology for high-definition television when everybody knew that the Americans' digital technology was the system of the future. It was also necessary to ask whether zero-gravity research should continue to be supported in the present form, Wissmann said.

In general, Wissmann takes the view that research should be more European than in the past, especially since increasing research subsidies can only be expected at EC level. "With European resources growing, there is no need to continue doing in Germany everything that used to be done there," the politician stresses. "For a lot of projects you only have to look over the fence, even for cooperation with large-scale research institutes. If we are to meet the Japanese challenge, we must move ahead more offensively as Europeans," Wissmann says with an eye to the traffic control systems developed by various car firms. He believes there is still too much narrow-minded interest group policy in Europe.

### Most Modern Transport System

Incidentally, the Thyssen plan for the Transrapid magnetic levitation railway will be ready in March. Wissmann only wants to be involved in this "most modern transport system in the world" if it is a private sector project. This means management and operation must be a state responsibility. In the past, Bonn has given some DM1.6 billion support to the project.

### Italy: Science Park Project Presented

93MI0374 Turin *MEDIA DUEMILA* in Italian Feb 93 p 95

[Text] A project has been presented for the establishment of an advanced services area in Val Basento (Basilicata) that will host high technology industries whose production is closely associated with their own scientific research activities or those of other institutes. The project—which will last 10 years and includes an operational portion that could be started immediately—faces all the aspects of strategic planning, company consulting, computers, telematics, and engineering with contributions from a temporary group of specialist companies such as Anderson Consulting, Basica, and Fiat Engineering.

There will be three focal points: **Tecnoikos**, consisting of a center for innovation, a research and industrial development center, a training and demonstration center, and strategic park management. **Industrial park**: an area designed to host newly-established industrial activities. **Services center**: designed to supply logistic support for both internal and external environmental conservation activities and functions.

The project provides for other operations that will revolve around these points and that aim at a more comprehensive upgrading of the entire area, as well as an increased merging of industrial and technological activities with the agricultural and naturalistic features of the area.

"The Val Basento project will probably be one of the first science parks to be constructed in Italy. It will carry out a very important role not only in upgrading this area but will also be a model for the establishment of other the parks planned for in this country," stated Basilicata regional government president Antonio Bocca.

### Italy: Achievements of Agency for European Research

93MI0422 Milan *MEDIAPLUSNEWS* in Italian Jan 93 pp 14-15

[Text] Approximately two years have passed since the establishment of APRE (Agency for the Advancement of European Research) in September 1990 under the sponsorship of MURST [Ministry for Universities and Scientific and Technological Research], a nonprofit organization supported by organizations from the industrial sector and the scientific and academic community.

The strategic objective of the agency has been, and continues to be, increased Italian participation in EC research programs by improving information, promotional, and support services to those working in the sector. Over this time, the considerable volume of activity performed and the positive trend of Italian participation bears witness to the fact that APRE has been a driving force in the internationalization of our research system.

The positive responses to the latest notification of Framework Program II and the first notifications of Framework Program III confirm this assessment both in the projects presented and the result of the selection, especially in the BRITE/EURAM [Basic Research in Industrial Technologies for Europe/European Research on Advanced Materials], Agroindustry, and CRAFT [Cooperative Research Action for Technology] programs.

The intense activity carried out by APRE over the past two years corresponds to its objectives and to the four priority areas of interest: depressed technological areas; southern Italy; technological innovation and small and medium-sized industries; relationship between industries and universities.

Depressed technological areas are sectors that are considered to be priority areas within the framework of national policy but insufficiently international on the European level or not well-represented in terms of European cooperation. APRE therefore decided to focus its attention on the following programs: BRITE/EURAM (industrial and materials technologies), ESPRIT [European Strategic Program for Research in Information Technologies], RACE [Research and Development in Advanced Communications Technologies in Europe], Agriculture and Agroindustry.

Similarly, but to a lesser extent, there is a gap between the country's potential and participation in EC research programs in the sectors of energy, the environment, biomedicine, and biotechnology, a gap that the agency has tried to fill by concentrating on the relevant programs.

The South has drawn the attention of APRE considerably over the past two years.

One can say that APRE's commitment in the South is already almost triple that of "natural demand" and is destined to grow in the future.

APRE's commitment in the South consists of organizing targeted meetings with southern Italian businessmen on the BRITE/EURAM and Agroindustry programs in cooperation with IASM [Institute for Assistance in the Development of the South].

APRE has placed the utmost attention on technological innovation programs.

And in line with new EC trends, there is a growing commitment to industrial innovation, the optimization

of results, and the economic impact of research. This is demonstrated by the large number of initiatives involving programs such as BRITE/EURAM, ESPRIT, Agroindustry; the focus on programs for innovation even outside the Framework Program such as SPRINT [Strategic Program for Innovation and Technology Transfer] and Eurotech Capital; and, for the first time in Italy, the organization of BRITE/EURAM and VALUE (EC program for the dissemination and utilization of research results in science and technology) days on behalf of the EC Commission and in conjunction with the launching of programs.

As for small and medium-sized industries, it is worthwhile remembering the considerable volume of activity being developed around the BRITE/EURAM program, which is the most open to the participation of small and medium-sized industries: about 30 ventures, half of which specifically aimed at small and medium-sized industries. APRE has been designated the National Focal Point for Italy, meaning it has been officially assigned the task of promoting the projects reserved for small and medium-sized industries within BRITE/EURAM.

Other initiatives bear witness to the role played by APRE at the service of small and medium-sized industries: its contribution to the development of the Relay Centers network for the advancement and enhancement of EC research; participation in the Euromanagement project (small industry audits to assess their potential participation in research programs).

Finally, the establishment of decentralized APRE offices, for example Milan, will enable the agency to better distribute and target its services, all to the benefit of small and medium-sized industries.

In addition to its Rome and Milan offices, the agency currently has two information centers in Genoa and Bologna.

The agency has attempted to set up regular information channels with most universities in order to improve relations between industries and universities and increase the participation of Italian universities in EC programs.

APRE's recent membership in the Permanent Rectors Conference represents an opportunity to increase its presence in universities and its role in stimulating and promoting closer cooperation between universities and industry.

For this purpose, and in addition to the numerous information days held in the universities, "APRE points" have been established for each university. These are either facilities or reference points for EC R&D programs, and are designed to disseminate information and stimulate university participation in EC programs.

Over the past two years of activity, specific tools have been developed:

- The "European Research" bulletin on R&D programs promoted and funded by the EC that is distributed to around 1,000 organizations having an interest in EC programs and selected on the basis of their ability to pass on the information to potential participants;
- information days and targeted meetings with those working in the sector;
- the "Research and Development" column published in the IL SOLE-24 ORE Europa Insert;
- the APRE documentation center which systematically collects updated information—whether official or unofficial—on EC programs;
- the EURIND database on national companies, divided into sectors of activity;
- CORDIS database access and consultation given APRE's role as a CORDIS correspondent for the EC.

In the future it will become necessary for APRE to provide increased support to those submitting R&D projects, without neglecting its information activities, in order to meet the growing demand from national operators.

(Source APRE)

## CORPORATE ALLIANCES

### France: Northern Telecom, Matra Alliance Developments

93P60168 Paris 01 Informatique in French 19 Feb 93 p 7

[Text] The strategic alliance between Northern Telecom and Matra Group resulted in new developments concerning the Canadian company's Meridian autoswitches and Matra's Matracom 6500s. Envisaged among the joint developments will be the combining of PABX (private automatic branch exchange) wireless operations and Matra PABX systems in September, and adopting the QSIG [quality standard inspection] interoperability standard for PABX systems in early 1994. Differences in ATM strategies will stay unchanged: Matra is interested in private networks, Northern Telecom in public ATM networks. However, a common association will be created for exploiting WAN (wide area network) communications. For the "private" ATMs, Matra is relying on a U.S.-produced component, based on a switch that is still under development. This equipment should connect the Ethernet networks and the ATM-card-equipped PABX 6500s by way of a 34-MBPS ATM link.

### Matra Buys Renault CAD/CAM Subsidiary

93WS0274A Paris PRODUCTIQUE/AFFAIRES in French 20 Jan 93 p 1

[Article: "Sediscad Joins Matra Datavision"]

[Text] Matra Datavision has taken over in its entirety the stake that Renault Automation has fully owned until



now in Sediscad. This former Renault Automation subsidiary specializes in CAD/CAM software and is responsible for the distribution of the Les Ulis-based group's Euclid and Master softwares, and the marketing of the supplementary application softwares (Unimesur, Robot CP) developed by its teams, as well as of Perceval, a computer-aided quality-control software developed by Renault. In 1992, this CAD/CAM sales and support activity, staffed by 42 persons, and centered mainly on the automobile manufacturing and related industries, represented a revenue of 62 million French francs [Fr]. As part of the takeover, an agreement signed with Renault SA permits Matra Datavision to use Perceval as a basis for developing an application to automate the digitizing and control operations of measuring machines. This new application is to be marketed worldwide and will add to the Matra Datavision line, which includes Drawmaster for drawing, Surfmaster for machining, and Foldmaster for sheet-metal work. This evolution in its team-up with the Renault group, which is a shareholder in Matra Datavision through the group's 45 percent stake in the holding company that controls Matra Datavision, bolsters the Matra Davidson's position in the mechanical-industries CAD/CAM sector, and especially in the automobile sector. Renault Automation, whose capital shares are held by Renault SA, employs 1200 persons and had a revenue of Fr1.3 billion in 1991. Its activity is based mainly on the production of capital equipment for the automobile and heavy truck manufacturing and related industries. As a company of the Matra-Hachette group, Matra Datavision is one of the world's leading suppliers of CAD/CAM systems. It employs 430 persons, had a revenue of Fr447 million in 1991, and is present in 36 countries. It has an installed base of 43,000 Euclid licenses granted to over 1,800 industrial clients in the mechanical, automobile, aeronautical, and electromechanical sectors.

*Matra Datavision (Alain Roumiguier) - 32 avenue de la Baltique, 91840 Les Ulis. Tel (1).69.82.24.00.*

#### **Framatome Connectors Buys Daut & Rietz**

93WS0274 Paris L'USINE NOUVELLE in French  
28 Jan 93 pp 30, 31

[Article by Jean-Pierre Jolivet: "Framatome Connectors Doubles Its Capacity To Serve Automobile Industry"]

[Text] *In this sector in the throes of reconfiguration, some groups are selling their activities, others are restructuring. Those that want to remain in this market are seeking critical size.*

The days of firmly-established positions are no more! The electrical connectors industry is experiencing a period of regroupings. In the most recent sudden development, Framatome Connectors International (FCI), the number one French and fourth-ranking worldwide producer of connectors for electronics and electrical use, with a revenue of 3 billion French francs [Fr] in 1992,

has bought the German firm Daut & Rietz, which specializes in connectors for the automobile industry.

This acquisition is in keeping with the strategic line Jean-Claude Leny, chief executive officer of Framatome, has pursued since he launched his group on the way to diversification in 1987. The takeover of Daut & Rietz, 90 percent of whose revenue of Fr330 million is derived from the German and Austrian automobile markets, strengthens FCI's second-place position in the European market, behind the American AMP company. The operation is a significant one: FCI more than doubles the automobile-sector activities of its subsidiaries Schmid, Connectral (well-established at Renault), Burndy (supplier of Fiat), and Souriau (name recently changed to Framatome Connectors France)—a sector deemed strategic by the group. "While the world market for connectors is growing at the rate of 1 to 2 percent annually, the automobile segment of that market is experiencing an annual growth rate of 15 percent. Cars at the high end of the line are using more and more electronics," says Michel Cuilhe, deputy general manager of FCI. The Safrane's 150 connectors represent a value of Fr800, or 30 percent more than those on the R 25.

After two difficult years during which growth did not exceed a few percent, the connector industry worldwide is undergoing a new reshuffle of the cards. Big groups, refocusing their activities, are striking connectors from their long-range plans. Du Pont recently sold its connectors activity (\$400 million in revenue) to members of its management staff. It will now be known as Berg Electronics. TRW has now sold its subsidiary Daut & Rietz. U.S.-based Hughes has announced its intention to sell its connectors activity. And Siemens, burdened with its troubled components branch, is studying the fate of its connectors activity...

Those that have decided to remain in the market are accelerating their restructuring. After a difficult 1991 that saw FCI's sales plunge almost 8 percent, and a reduction of its Souriau subsidiary's staff by 120 employees in June of last year, FCI is fast restructuring its subsidiaries. They will be more integrated in the future. As part of a restructuring plan that reorganizes the group's activities into four independent divisions, by specialties, the French-based Radiali group, the European leader in coaxial connectors, has announced the elimination of 150 jobs out of the group's total of 1,180 employees, mainly at its Isere-based plants at Voreppe, Voiron, and Isle-d'Abeau, as well as its Chateau-Renaud (Indre-et-Loire) plant. The phenomenon is not sparing American companies. In June of last year, the Amphenol company undertook a reorganization of its activities, based on a specializing of production sites. And ITT Cannon has created two distinct divisions to separate its military and aerospace activities from those concerned with civil applications.

With the exception of the world's number two, Molex, which played the card of Southeast Asian markets and of

the delocalization of microcomputer production facilities, the connector manufacturers have all taken the full brunt of the worldwide stagnation in electronics, particularly in the military, aeronautical, and computer sectors, which represented more than 40 percent of their sales.

The industry must also bear the costs of R&D, which do not yet equal those of the semiconductor sector, but are rising. With miniaturization, and the constraints tied to their use in severe environments, as in the case of the automobile, the technologies used are becoming more and more sophisticated. These technologies concern materials (polymers, technical plastics) as well as manufacturing methods (electrodeposition, metallurgy), and interconnection methods (high-bit-rate connectors, optic plugs and jacks, composite casings). From an industrial viewpoint, the imperative need to localize production near markets is a limitation on the rationalization of manufacturing processes.

These are all constraints that have the connector manufacturers chasing after the indispensable critical size that will enable them to continue among the industry's principal players.

[Box p 30]:

#### Kabelmetal Scores Points

Will the development of automobile connection technology bring about a reshuffling of the cards among the suppliers of copper laminates used by the automobile manufacturers? One supplier hopes so: Germany's Stolberger Metallwerke, a subsidiary of Kabelmetal of the Europa Metalli group. The electrical problems being encountered in the manufacturers' top-of-the-line vehicles, such as the 605, XM, Safrane, and others, have drawn the manufacturers' attention to the materials involved.

The rise in temperature under the hood, and the higher amperages being required, are hard for brass connectors to withstand, say Stolberger's engineers. Instead, they offer microalloys of copper—copper microalloyed with magnesium, silicon, or nickel, for example—whose electrical and mechanical performance characteristics are superior to those of the traditional copper-zinc alloy.

These microalloys, which Stolberger's general manager, Hans Brickmann, acquired the license to manufacture, after years of negotiations with Mitsubishi, are present in recent models, such as Opel's Astra, the Safrane, and the new Citroen Xanthia. They are the German firm's best sales argument.

## CORPORATE STRATEGIES

### Temic's Plans to Become Global Microelectronics Firm

93WS0263A Duesseldorf *HANDELSBLATT* in German  
9 Feb 93 p 21

[Article by Georg Heller: "On the Way To Becoming a Global Player on the Microsystems Market"]

[Text] *HANDELSBLATT*, 8 Feb 93 HEILBRONN—Penetrations of the consumer electronics market have made business for Temic, Daimler-Benz's new microelectronics company, more difficult. Nonetheless, Frank Dietrich Maier, chairman of the board of business management, does not believe that company plans, which call for Temic to cross the profit threshold by the mid 1990s, are endangered.

The activities of Daimler-Benz in the fields of microelectronics and automotive equipment concentrated in Temic, which was established on 1 November 1992. AEG, which is more production-oriented in this field, has entered into a business marriage with DASA, which is more development-oriented, for the purpose of combining the necessary company resources.

This joint subsidiary, which is based on the research potential of the Daimler-Benz Company, has made its appearance on the market as a global supplier of semiconductors, microsystems, auto equipment, and special technologies. Production sites in Europe, North America, and the Far East will be built up into a major production association.

Real investments of 1.5 billion German marks [DM] and about as much for R&D are intended to make Temic into a worldwide, competitive company in semiconductors and microsystems technology on a global market that is characterized by overcapacities, innovative product competition with cut-throat price wars, and even a dwindling market in certain sectors.

By virtue of its acquisition of AEG, Daimler-Benz entered into direct market competition with Bosch in the automotive equipment field. Even though great growth rates can be expected in automotive microelectronics in the near future, it is apparent that capacities will increase at an even greater rate. In the long run, this will not be a lucrative business however.

Nonetheless, in the opinion of Daimler company strategists, the development and production of microsystems, which are increasingly taking over more and more functions in the automobile industry (as in the aviation and space industry, information and communications technologies, and household equipment), can no longer be left simply to suppliers as was the case in the past for mechanical, hydraulic, and electrical components.

### Systems Science Decides Competitiveness

In their "Consensus Paper on the State of Microelectronics in Germany," compiled late last year, Bosch, Daimler-Benz, IBM, and Siemens summed up the situation as follows: "System know-how is being implemented at an accelerating rate with increasing integration density." If a chip has to be imported from a company that is at the same time a competitor in system development, then that company-specific system know-how, which was developed at great cost, also goes directly to that competitor, who can use it in competitive products." And it is this system know-how that in the final analysis is the decisive factor in the market competitiveness of the end product.

It is precisely this opinion of company strategists that answers the question as to why Daimler-Benz is pumping billions into R&D for a market that appears to promise billions in losses rather than a modest profit at best. "Behind the establishment of Temic is the expressed intention of the Daimler-Benz Company to assure and further develop over the long-term the strategically important technological platform in microelectronics and automotive equipment considered essential for the business activities of Mercedes Benz, AEG, Deutsche Aerospace, and debis," Maier, who is also AEG's responsible officer for microelectronics, maintains. The ability to develop and produce microsystems is the decisive factor in achieving a technological advantage and consequently a competitive advantage in the automobile and other end products.

### Concern Over the Dominance of the Microelectronics Producer

This strategy runs directly counter to the outsourcing policy, currently practiced in the Daimler-Benz Company. At a time when the Mercedes chairman, Helmut Werner, breaking all company taboos, announces that one company should not produce what another can produce better and cheaper (and does not even exclude engines in vehicles adorned with the Mercedes star on the cooler), the same company is investing billions in a worldwide R&D cooperative venture in microelectronics and automotive equipment.

The reasons for this seemingly contradictory behavior have been openly stated. Primarily in the field of automotive equipment, the strategists of the former automobile producer fear that they could easily fall under the dominance of microelectronics producers, who are simultaneously competitors against the same end products.

To the question as to whether German industry could become strategically dependent on the five largest Japanese companies—Toshiba, NEC, Hitachi, Fujitsu, and Mitsubishi—for their microelectronics (of course Daimler-Benz wants to cooperate with Mitsubishi!), the consensus paper made a very significant comment to the effect that the Institute for World Economy and an IFO study conclude that there is no need now for any

industrial-political action because of the existing intensive worldwide competition.

Another IFO study, on the other hand, comes to the conclusion that experience has shown that on the hotly contested international markets, the technology-givers "serve" their competitors only by putting the appropriate "innovation distance" between them. But is that also valid for Daimler-Benz and the German suppliers Bosch and Siemens? The logic, according to which Daimler-Benz becomes a producer of microsystems and automotive equipment to compete against rather than cooperate with Bosch and Siemens is not compelling. The decision to establish an integrated technology company is obviously not the consequence of multiple forces, but rather was taken autonomously. Daimler-Benz has the technological and financial prerequisites to develop itself into an integrated technology company, and the decision to risk it has been taken. Temic is the very heart of the implementation of this concept.

In the field of semiconductors, Maier sees Temic's strength in application-specific circuits, which should become the focus of its activities. The Temic prospectus confidently notes that such custom-tailored chips will decisively mark "technological development in almost all industrial spheres." The company has, for example, developed a chip that incorporates all the functions of a telephone capable of being programmed differently depending on country regulations, and, if need be, has only to be connected with dial keyboard and headphone.

In the field of microsystems, Temic is developing "custom-tailored problem solutions" for use in automotive electronics, industrial electronics, aviation and space, as well as in data-processing and telecommunications. The long-term goal is to integrate microelectronics, micromechanics, microoptics, and microchemistry on a common silicon chip.

With capabilities in microelectronics, sensors, electronics, communication technology, and power plant technology united in the one company, the automotive equipment operation would be in a position to distinguish itself from the competition and to develop a strong market position. The fifth generation ABS, which is supplied with the Teves, has just gone into production; the highly integrated sixth generation is scheduled to be ready in mid 1994. The automotive equipment sector will develop from a component to a system supplier on a global basis, and the turnover should more than double from about DM700 million in 1992 to DM1.5 billion within five years.

### Turnover To Grow by 60 Percent to DM4 billion by 1996

In 1992 Temic, with 16,500 employees worldwide, had a turnover of DM2.5 billion. Planners foresee a growth of 60 percent to roughly DM4 billion by 1996; the automotive equipment sector, which plays a leading role in Mercedes Benz innovations, is also to be expanded.

Juergen Schrempp, chairman of the board at DASA, emphasizes Temic's market orientation, which in no way is intended for the role of a dependent company supplier for Mercedes Benz. In-house supplies ought not exceed 20 percent of Temic's turnover.

Schrempp puts Daimler-Benz's current demand for electronic components and systems for products in the automotive, the communications, the automation, and the aviation and space technologies at DM6.5 billion. Of this, about 7 percent has been covered from in-house suppliers to date, i.e., about DM450 million. When the 20 percent planned for 1996 has been reached, that would represent approximately a doubling of that amount.

Since the real purpose of Temic is that of a technology source, which will ensure a competitive advantage for the company's products, it is not so much a matter of the absolute value of the microsystems supplied, which make up only a small fraction of the total costs of the piece of equipment. What is essential is that the company succeed in maintaining its technological advantage without incurring substantial losses. Maier hopes to bring Temic over the profit threshold by 1996, though the preliminary work needed to bring this about is enormous.

The overview plan for Temic, as it is expected to appear by the mid 1990s, exists only on paper for the time being. The potpourri of activities engaged in by AEG, Dornier, MBB, and even by Daimler-Benz before the reorganization, has to be sorted out and integrated into a single company, which is simultaneously being outfitted with the most modern production technologies available.

A flexible automatic wafer production facility, which will assure Temic the leading role in the flexible production of silicon wafers in Europe, is being established in Heilbronn at a cost of about DM100 million. In the new Heilbronn plant, Temic will undertake the JESSI project FAW (flexible automated wafer fab) in conjunction with the JESSI project FAS (fast access to Silicon). Some 200 million circuits, many of them highly complicated, will be produced yearly as a result of these programs.

As far as possible, site advantages are to be selected by the company's worldwide production association. For example, the enormous production costs advantage to be had in Manila; already 4,000 workers are employed in the Temic plant there. The production capability of the Eching plant, near Munich, will be moved to Manila as facilities there expand. At the same time, an international presence is being further established. In addition to the plants in Manila, the United States, and France, as well as some involvement in Taiwan, there are production facilities in Mexico (automotive component assembly), the former Czechoslovakia (cables), and Hungary (microsystems). Investments in physical plant and development will be DM450 million in 1993 and DM465 million in 1994.

#### Worldwide Production Associated Provides Site Advantage

Thanks to Temic, the results of Daimler-Benz's great research potential will find much broader market access than the end products of its original concern ever found. In that respect, too, the establishment of Temic makes sense. For example, Daimler-Benz is performing research in the technologically virgin soil of AMS (active matrix system) LCD technology. Maier asserts that Temic, together with a partner, will produce these new displays. Maier will say nothing about the extent of losses expected to be incurred through restructuring and integration, which will certainly affect employment in Germany as well. Just for 1992, a figure of DM100 million has been cited, but not confirmed by Maier. Penetrating new markets has usually resulted in higher than expected losses in any case. The transformation of Daimler-Benz into an integrated technology company will still cost a lot more money in aviation and space as well as in the microsystems field.

#### Technological Competitiveness of German Industry Discussed

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[Text]

#### Table of Contents

1. Germany's New Trading Position in R&D-Intensive Goods
2. The World Economy and the German Economy in Fall 1992
3. Germany's Trade in R&D-Intensive Goods in 1991
4. Overall Economic Significance of R&D-Intensive Industries
  - 4.1. Production (Original Federal Laender Only)
  - 4.2. Employment in R&D-Intensive Industries
5. Comparison of the Structural Features of R&D and Innovative Work in the Major National Economies
  - 5.1. R&D Expenditure
  - 5.2. Innovative Work in German Industry
  - 5.3. International Trade in Patent Rights and R&D Services
  - 5.4. Patents as Pointers to Future Key Areas of Technology
    - 5.4.1. International Patenting According to Product Groups
    - 5.4.2. National Specializations in Innovation in the R&D-Intensive Sector

### 5.5. Foreign Trade Specialization and Patents Granted in Major Industrialized Countries in the R&D-Intensive Sector

#### 5.6. "Strategic" Sectors of Industry

##### 1. Germany's New Trading Position in R&D-Intensive Goods

Owing to German unification, the phase of economic growth that came to an end worldwide at the end of 1990 continued for just under a year in the Federal Republic. German industry was able to take advantage of this unusual economic situation to widely varying degrees, depending on the sector. While the trade flows from consumer sectors, such as the automobile industry, were partially diverted to the new federal laender and imports from these sectors increased, producers of investment goods in particular had to stand their ground in a world economy that was already showing signs of recession. This trend has now increasingly affected even those branches that had initially benefited from the boost in demand from the new German laender<sup>1</sup>.

Germany's trading position in R&D-intensive goods is currently influenced by two partly overlapping, far-reaching developments: the worldwide slump, and the repercussions of German reunification, which are exerting a specific influence on the economy, even that of the original federal laender. As a result of unification and the consequent change in the statistical reporting unit, only very limited comparisons with other countries and earlier periods can be made. Moreover, the indicators used only describe average values obtained from the widely differing subsectors of the economy.

Considering its new geographical borders, the Federal Republic of Germany has fewer obvious advantages as regards trade in R&D-intensive goods in certain sectors, though no abrupt change from advantages to disadvantages, or vice versa, has been observed in any of the R&D-intensive sectors, as compared with the former territorial area. On the whole, these statistically measurable changes are not to be equated with a fall in the technological competitiveness of German industry; rather, they are the result of increased demand from the new German laender, which diverted some of the products of German industry from foreign destinations to domestic markets, and stimulated more imports into Germany.

These effects make it clear that the Federal Republic's trading situation must now be looked at in a new light. Comparisons with last year's results of the original federal laender must take this into account. In the long term, moreover, it is not inconceivable that the enlarged German internal market will lead to a shift in the importance of foreign trade as a proportion of the gross national product.

In 1991, the Federal Republic of Germany exported goods to the value of 666 billion German marks [DM], equivalent to an 11.19 percent share of world exports. It

thus came just behind the United States (11.72 percent) and way ahead of Japan (8.73 percent). This fall, compared with the previous year (11.55 percent, old borders), was probably also essentially a consequence of the trade diversion mentioned above. The FRG thus had a balance of trade surplus of DM22 billion. R&D-intensive goods, which earned a balance of trade surplus of DM87 billion in 1991, played an important part in offsetting balance of trade deficits in other sectors.

The balance of trade of the old German laender (including the export surplus in trade with the new German laender) hardly fell at all in 1991 compared with 1989<sup>2</sup>. Both in terms of Germany's trading position in manufactured industrial goods as a whole and in terms of trade in R&D-intensive goods, however, there are some structural developments that should be watched very closely in the future:

- As in previous years, the increase in German exports as a whole (2 percent in real terms) remained well behind the trade growth of the OECD countries (4.5 percent overall)<sup>3</sup>;
- The supply structure of the West German national economy shifted markedly during the eighties. German industry suffered conspicuous losses, particularly in sectors where microelectronics is an important factor, for example in data processing systems and home electronics devices<sup>4</sup>;
- In spite of the temporary difficulties in the investment goods sector, there was an upward trend in the mechanical engineering and automobile industries in the mid-eighties<sup>5</sup>.

As far as German industry is concerned, the supply of R&D-intensive goods has increasingly shifted to sectors that have experienced below-average growth rates compared with the industry average. At the same time, their main feature—a particularly high export surplus compared with the average—has become weaker in areas such as telecommunications systems, which showed above-average growth rates in recent years. This development must be monitored very closely in the future. It should also be noted that in those areas where German industry is already showing weaknesses, the patent statistics also provide evidence of below-average inventiveness.

Germany has traditionally had a competitive advantage in products characterized by high-quality design and advanced technology, which require a highly skilled workforce and considerable scientific, technical, and organizational expertise. German industry must use these strengths more intensively than before, in product sectors other than those where Germany has traditionally excelled as well, if new technology markets are to be opened up with good opportunities for growth and profit.

On the whole, the economy of the original federal laender is one of the most technologically productive



economies in the world. The data now available, however, suggests that the pace of innovation seems to have slackened off. Although this decline could be a consequence of the unusual economic situation due to German unification, it is taking place at what is conceivably the most inauspicious time in view of the strained world economic situation, which has now evidently reached Germany, too.

As a result of unification, research in Germany as a whole has grown considerably and widened in scope. This means that important additional research topics can be taken up in many promising areas owing to the increased research capacity. State-funded basic research in Germany, which leads the field internationally, is playing an important part in creating a productive scientific environment, which is essential for successful R&D work in industry.

The initiative to make full use of Germany's advantages as a center of science and research must come from industry. Precisely because of the present economic situation, a cutback in industrial investment in R&D would be a false economy. German industry can only use its competitive advantages by working systematically and constantly towards a long-term industrial policy that attaches the necessary value to R&D<sup>6</sup>.

[Box, p 2]

#### R&D-Intensive Goods

R&D-intensive goods are defined in business terms. They comprise: **Leading-edge technology:** R&D expenditure at least 8.5 percent of sales income;

**Advanced technology:** R&D expenditure between 3.5 and 8.5 percent of sales income.

Definition of the Fraunhofer [FhG] Institute of Systems Engineering and Innovative Research (ISI). [End box insert]

#### 2. The World Economy and the German Economy in Fall 1992

The economic weakness of the industrialized countries has not yet been overcome. This applies equally to North America, Japan, and Western Europe. Nevertheless, conditions in many countries are better for industry than they were at the beginning of the eighties. Industrial profits, although temporarily eroded by the economic downturn after the long boom, are better than a decade ago because of tax concessions and a wage restraint policy<sup>7</sup>.

The five major economics research institutes assume that the gross domestic product of the OECD countries will increase in real terms by about 2 percent in 1993 and will thus be only slightly higher than in 1992. The rate of inflation of private consumption is estimated at over 3 percent. According to the institutes, the volume of world trade will expand by about 5 percent.

After the lengthy upward trend of recent years, both the five institutes and the Council of Experts consider the current economic situation in Germany as very sluggish.

[Box, p 4]

#### R&D-Intensive Branches of Industry

##### Leading-Edge Technology:

- Production and processing of fission and breeder materials;
- Aircraft and spacecraft engineering;
- Production of metering, telecommunications, and measurement and control equipment, etc.\*;
- Optics (excluding ophthalmic optics, photography and cinematography);
- Production of medical and orthopedic products;
- Production of pharmaceuticals;
- Production of data processing equipment and systems\*.

##### Advanced Technology

- Production of machines for the food and drink industry, chemical industry, etc.;
- Production of steel works and rolling mill equipment;
- Production of building, building materials, and similar machinery;
- Production of cogs, gears, bearings, etc.;
- Production of machinery for other particular sectors of industry;
- Other types of mechanical engineering;
- Production of motor vehicles and engines;
- Production of batteries, accumulators;
- Production of devices and systems for electricity generation, distribution, etc.;
- Production of electric lights and bulbs;
- Production of electrical household appliances;
- Production of radio, television, and sound systems;
- Ophthalmic optics;
- Production of photographic, projection, and cinematic equipment;
- Precision engineering;
- Production of basic chemicals;
- Production of chemicals for industry, agriculture;
- Production of photochemical products;
- Production of chemical fibers;
- Production of office machines\*.

\*These sectors are also referred to as the "microelectronics-determined sector" in this report (Source: FhG-ISI, 1992). [End box insert]

#### 3. Germany's Trade in R&D-Intensive Goods in 1991

In the following analysis based on 1991, only the RCA [revealed comparative advantage] can be used to measure specialization in foreign trade, since only national not international, trade figures for Germany (post-unification status) are currently available for 1991.

The year 1991 was the first year for which the foreign trade specialization profile for the new German territory

could be drawn up. Now that the new laender have joined the Federal Republic, Germany must be completely reassessed as a competition for world market shares, including the technology-intensive goods market.

In 1991, industrial goods valued at more than DM640 billion were exported from the Federal Republic of Germany (post-unification), and goods worth just under DM567 billion were imported. R&D-intensive goods accounted for 48 percent of the exports (DM307 billion) and 39 percent of the imports (DM210 billion). In terms of value, more than 70 percent of the technological goods exported fell within the advanced technology sector, the proportion of imports being just under 60 percent. R&D-intensive goods accounted for about 46 percent of all exports and 34 percent of imports.

Even following unification, therefore, the Federal Republic of Germany specializes chiefly in the advanced technology group of R&D-intensive goods. In contrast, there is a slightly negative balance in leading-edge technology. Germany shares with Japan this specialization in advanced technology goods, which account for far more sales income than leading-edge technology goods. This shows that Japan remains the main competitor on the world market, even for the unified Germany.

Machinery accounted for the largest proportion (25 percent) of exports of R&D-intensive goods, followed by motor cars (nearly 20 percent), chemicals (17 percent), electrical products and machinery (over 12 percent each), and aircraft and spacecraft<sup>8</sup> (over 11 percent).

#### [Box, p 5]

#### Parameters Used

The RCA (Revealed Comparative Advantage) indicates sectors that enjoy a leading position in the international league by identifying the extent to which the balance of trade in one branch differs from the balance of trade for manufactured industrial goods as a whole. Positive RCA scores indicate the comparative advantages that a country presents, whereas negative scores indicate comparative disadvantages.

A country's position in a product group on the world market is shown by the RWA (relative world market share), which indicates the difference between a country's share in the world export market for one particular product group and its share in exports as a whole. Positive RWA scores confirm above-average export specialization in a particular product group, whereas negative scores show a below-average export volume on the world market. The RWA focuses solely on the "export achievement" of a country in one product group. The results of the portion of an industry that does not trade on international markets but operates on the domestic markets of foreign competitors are not taken into account by this method of analysis. Consequently, both the RWA and the RCA should be used when analyzing

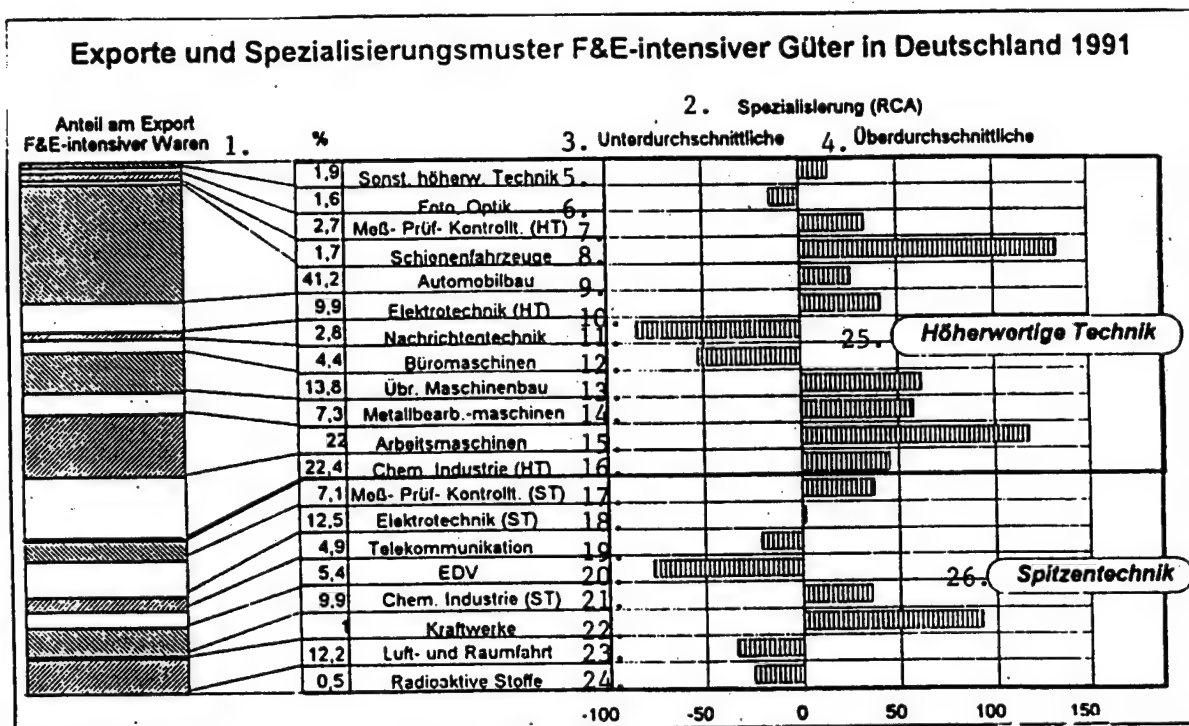
foreign trade specialization. The RWA is not yet available in an internationally comparable form for the unified Germany. [End box insert]

Germany has a high level of specialization in technology-intensive goods. Compared with industry in the original federal laender, however, the level of specialization is [now] lower. Though the sectorial ranking is the same, Germany's position with respect to the other major countries supplying R&D-intensive goods is thus different from that of the original Federal Republic.

Even following unification, Germany has the highest degree of specialization worldwide in R&D-intensive goods among the major industrial countries, ranking behind Japan but in front of the United States and Great Britain. Compared with the original Federal Republic, the gap between Germany and Japan has increased markedly, however, and the lead over the other major suppliers of technology goods has narrowed considerably. This change in level is attributable solely to reduced specialization in advanced technology. In view of the great importance of this product group in German foreign trade, Germany's position will depend largely on how quickly and thoroughly industry can be modernized in the new federal laender and to what extent the latest technology is used in the process.

German specialization in leading-edge technology is predominantly below average, in the unified Germany as well. This is due to factors including the adverse trade balance in the relatively important aircraft sector, and in the microelectronics-dependent industries. Most product groups in the leading-edge technology sector have an above-average degree of German specialization. These include all the chemical goods that fall within the leading-edge technology category, including biotechnology products<sup>9</sup>, and advanced electrical products, optical instruments, measurement and control engineering, and power stations.

Within the advanced technology product groups, the degree of specialization for Germany as a whole is lower than for the original federal territory because of the above-average increase in imports, but negative scores are still the exception. In certain sectors, unification has evidently helped to improve the position compared with that of the original Federal Republic. This applies to virtually all the advanced technology chemical products, where an above-average number of R&D-intensive chemicals were exported by the new federal laender in 1991 compared with processed industrial goods as a whole, but only an average number of these products were imported. Producers of metal-processing machines, electricity distribution equipment, and advanced ceramics within the new federal laender have positive specialization scores. On the other hand, while the specialization scores in several other sectors (e.g., the automotive industry) are still positive, they are lower than those achieved in the original Federal Republic. This is largely due to the reorientation in trade following German unification.



**Exports and Pattern of Specialization in R&D-Intensive Goods in Germany, 1991**

Key: 1. Share of R&D-intensive goods exports 2. Specialization (RCA) 3. Below average 4. Above average 5. Other advanced technology 6. Photography, optics 7. Measurement/testing/control (AT) 8. Rail vehicles 9. Automobile industry 10. Electrical engineering (AT) 11. Telecommunications systems 12. Office machines 13. Other mechanical engineering 14. Metal processing machinery 15. Machine tools 16. Chemical industry (AT) 17. Measurement/testing/control (LT) 18. Electrical engineering (LT) 19. Telecommunications 20. EDP 21. Chemical industry (LT) 22. Power stations 23. Aerospace 24. Radioactive materials 25. Advanced technology 26. Leading-edge technology

The numerous strengths of German R&D-intensive industry in the advanced technology sector are also offset by weak areas. As in the leading-edge technology sector, these are primarily the microelectronics-dependent industry, equipment for electricity distribution, and certain areas of photography/optics.

In 1991, 2.5 percent of all German exports from the predominantly R&D-intensive branches of industry<sup>10</sup> came from the new laender. This figure represents a considerable drop compared with the previous year.

As regards exports of R&D-intensive goods from the new laender in 1991, above-average shares were achieved by builders of rail vehicles, ships, aircraft and spacecraft, and manufacturers of inorganic chemicals, medical and pharmaceutical products, machine tools, and metal processing machines. With the exception of the machine tool sector, the degree of specialization in Germany as a whole in 1991 was higher in these industries than the figures that they achieved in the original Federal Republic in 1990. Industry in the new laender hardly contributed at all to exports of motor vehicles, particularly cars, in 1991.

On the whole, exports of R&D-intensive goods by companies located in the new laender fell by nearly 60 percent compared with the previous year. This setback is due almost exclusively to the disappearance of the eastern European markets, but no new markets were won to redress the balance because of remaining competitive disadvantages compared with western competitors. There were particularly drastic declines in exports in photography/optics, motor vehicles, telecommunications systems, other electrical machinery, and office machines/computers.

Compared with 1990, industrial exports of R&D-intensive goods from the original federal laender remained virtually constant in terms of value, but there have been structural shifts within the export pattern. Above-average growth rates were recorded in rail vehicles, aerospace, medical and pharmaceutical products, and "other electrical machinery etc." Exports were also down in most product areas of the chemical industry.

In spite of the upturn in demand in the new laender, industry in the original federal laender just about maintained its position on the world market for R&D-intensive goods but was unable to keep pace with growth



in world trade as a whole. Although this also has to be seen against the background of production that was running close to capacity in the original federal laender in 1991, mainly because of unification, and could not, therefore, be expanded in the short term<sup>11</sup>, there are also indications that it might conceal a slackening in the pace of innovation.

#### **4. Overall Economic Significance of R&D-Intensive Industries**

In 1991, German exports of R&D-intensive goods were 1.39 times higher than imports, whereas exports of goods as a whole were only 1.03 times higher than imports to Germany. The balance of trade surplus achieved with R&D-intensive goods alone totaled DM87 billion in 1991, considerably higher than the total foreign trade surplus of DM22 billion. Compared with 1990, however, exports of R&D-intensive goods from the original federal laender were still 1.67 times higher than imports.

Without its trade in R&D-intensive goods, Germany would have had a substantial foreign trade deficit in purely mathematical terms. These figures emphasize the overriding importance of trade in these goods for the German economy, which is dependent on foreign trade. Consequently, it is extremely important for Germany that the free international trade be further facilitated. This underlines once again the importance for the German economy of a successful outcome to the GATT Uruguay round.

##### **4.1 Production (Original Federal Laender Only)**

Between 1980 and 1991, net production grew by an average of 2.4 percent per year in the converting industry as a whole, but by 3.4 percent in the R&D-intensive sectors of industry. The industrial upturn in the original federal laender that began at the end of 1982 was thus supported to a large extent by the R&D-intensive branches of industry. Nevertheless, trends in the individual R&D-intensive branches differed considerably.

At the beginning of the eighties in particular, leading-edge technology was an important contributor to the above-average development of the R&D-intensive industries. Especially in the first half of the eighties, the production of EDP equipment and systems proved to be an important growth factor in leading-edge technology. Since then, growth in this area has been average for leading-edge technology, and even the downturn in the world economy at the beginning of the nineties did not leave this sector unscathed. Nevertheless, between 1980 and 1991, by far the highest annual growth rates (11 percent) were achieved in EDP equipment and systems.

Production of metering and telecommunications equipment and measurement and control instruments grew at the above-average rate of 6.5 percent in the eighties; unlike the data processing sector, however, this growth has persisted to the present day. There has been a similar development over the last five years for producers of pharmaceuticals and medical/orthopedic products. In

the optical sector, however, the average growth between 1980 and 1991 was 3 percent, although capacities have been scaled down considerably since 1990, and the production index is now below its 1985 level.

Within the advanced technology sector, for example, there have been markedly opposing developments within certain branches of industry, the result of combined economic and structural influences. On the whole, net production in this sector has grown by an average of 2.8 percent per year between 1980 and 1991, a higher rate than average growth in the converting industry.

In terms of value, growth in production has also been significantly above average in motor vehicle construction (up 4.1 percent), electrical domestic appliances (up 4.6 percent), and home electronics (up 4.4 percent). These advanced technology sectors, which mainly produce consumer goods, have been able to benefit from the demand from the new laender, particularly in more recent times. Since 1989, moreover, the relevant R&D-intensive supply industries have benefited considerably from the expansion in the building industry fostered by the brisk pace of building in the new laender. These supply industries include producers of building and building materials machinery and for electricity generation and distribution equipment.

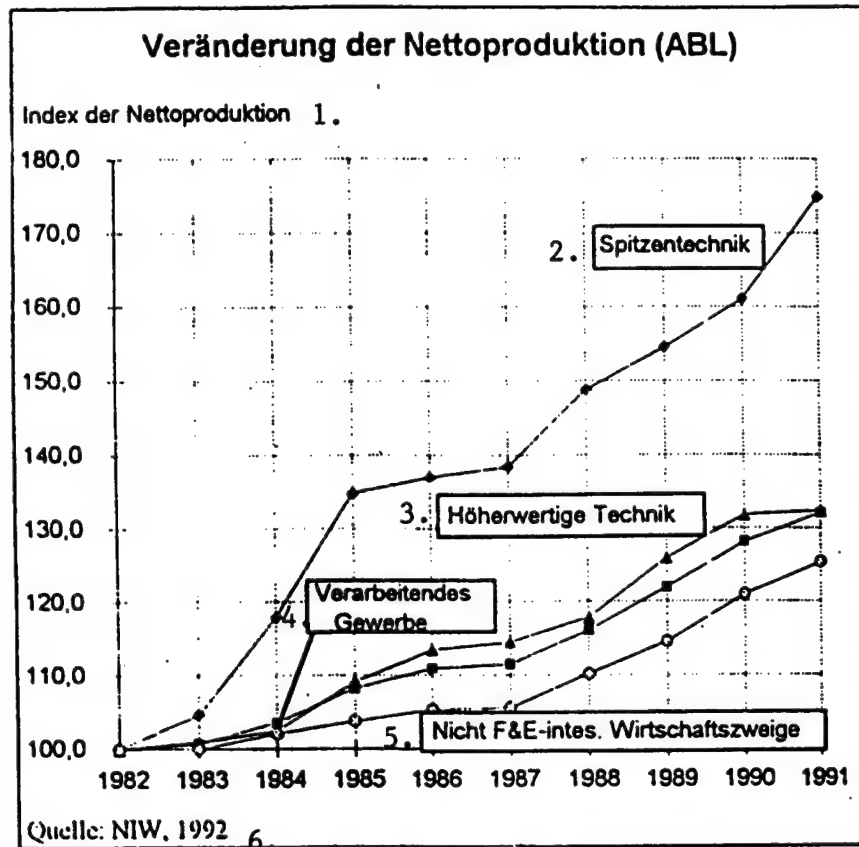
In the eighties, producers of office machines were adversely affected by structural change, their production falling by an annual average of 4.4 percent—a trend found in no other R&D-intensive sector. The production of cogs, gears, bearings, etc., batteries and accumulators, and chemical fibers also performed relatively poorly in the second half of the eighties.

##### **4.2 Employment in R&D-Intensive Industries**

As a proportion of overall employment in industry, employment in the R&D-intensive industries has increased from over 39.5 percent (1978) to over 44 percent (1991) in the original federal laender. The major branches of the manufacturing industry in terms of employment are the mechanical engineering and electronics industries, with just under 15 percent and 14 percent respectively. They are followed by the automobile industry (12 percent) and the chemical industry (8 percent).

In the new laender, mechanical engineering accounts for an even greater proportion of employment in the manufacturing industries than it does in the original federal laender employing nearly 20 percent of the workforce in 1991. It is followed, at some distance, by the electronics industry with 11 percent, the chemical industry with 7.5 percent, and the automobile industry with just under 5 percent.

Employment in R&D-intensive industries fell between July 1991 and July 1992, in both the old and new federal laender. As demand from the new laender has focused primarily on non-R&D-intensive consumer goods, thus supporting employment in these industries for somewhat



Change in Net Production

Key: 1. Net production index 2. Leading-edge technology 3. Advanced technology 4. Manufacturing industry 5. Non-R&D-intensive branches of industry 6. Source: NIW [Lower Saxony Institute of Economic Research], 1992

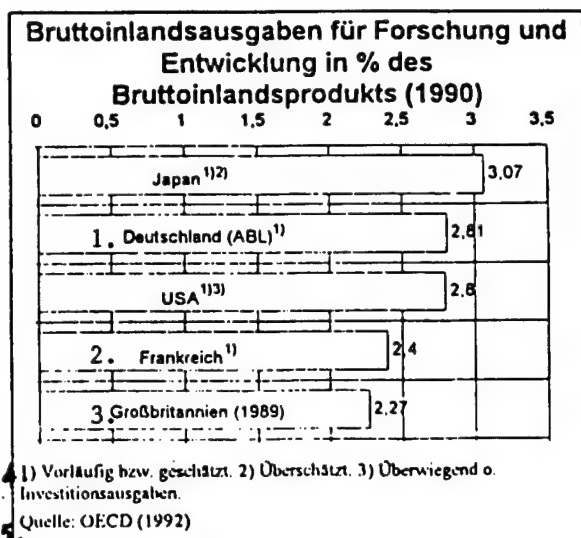
longer, the decline of more than 3 percent in the R&D-intensive sectors in the original federal laender even proved somewhat greater than the average for the manufacturing industry (down 2.5 percent).

Job losses were above average in the office machines/EDP, mechanical engineering, and electronics industries. Increasingly recessionary trends were felt in the mechanical engineering and electronics industries, and the disproportionately high job losses in mechanical engineering may point to fundamental structural problems in this sector so must continue to be monitored closely.

Due to the far-reaching structural adaptation problems faced by industry, 46 percent of jobs in the manufacturing industries alone and about half the jobs in R&D-intensive sectors were lost in the new laender between July 1991 and July 1992. The fall in employment in the office machines and EDP sector, where more than 80

percent of the jobs were lost in a year, was particularly drastic. There was also a 60-percent decline in jobs in the precision engineering, optics, and clock-making industry, formerly the GDR's showcase sector, although in percentage terms job losses in the other industries reflected those in the manufacturing industry as a whole.

Even in the original federal laender, after a long and unbroken period of growth in employment, there is now an overall decline in employment in the R&D-intensive branches of industry. Analysis over a longer period shows, however, that the leading-edge technology sectors in particular have proved relatively resistant to fluctuations in economic trends. The other R&D-intensive industries, in contrast, have essentially mirrored the general economic situation, though they have come through depressions more quickly and with higher growth rates than the other branches of the manufacturing industry. On the whole, technology-intensive sectors are thus less susceptible to employment fluctuations, which is why they are likely to be the first to show rises in employment once economic recovery gets under way.



**Gross Domestic Expenditure on Research and Development as a Percentage of the Gross Domestic Product (1990)**

Key: 1. Germany (original federal laender) 2. France 3. Great Britain (1989) 4. 1) Provisional or estimated 2) Overestimated 3) Predominant or investment expenditure 5. Source: OECD (1992)

**5. Comparison of the Structural Features of R&D and Innovative Work in the Major National Economies**

**5.1 R&D Expenditure**

With gross domestic expenditure on R&D accounting for 2.81 percent of its gross domestic product (GDP), the Federal Republic of Germany (original laender) came second among the major industrialized countries in 1990, behind Japan (3.07 percent) and in front of the USA (2.80 percent)<sup>12</sup>.

Figures that would make it possible to compare Germany as a whole at an international level are not yet available. Initial provisional estimates, however, show that, in 1991, R&D expenditure was about 2.7 percent of the GDP for Germany as a whole, this being an average for the original federal laender and for the new laender undergoing a process of radical change. It should be borne in mind, however, that, in spite of the fall in this percentage in Germany as a whole, the R&D resources of the new laender are now added to those of the original federal laender, which, even taken on their own, used to lead the international field. In spite of the temporary changeover difficulties, these new R&D capabilities nevertheless match the productivity of an average industrialized western country.

In 1990, Germany was in third place in the international league table for R&D expenditure in absolute terms. In view of the considerable differences in the size of the

**Bruttoinlandsausgaben für Forschung und Entwicklung (1990)  
- in Mio \$ Kaufkraftparitäten -**

1. Deutschland (ABL) <sup>1)</sup>	32 468
2. Frankreich <sup>1)</sup>	23 631
3 Großbritannien (1989)	19 525
Japan <sup>2)</sup>	66 863
USA <sup>3)</sup>	150 765
4. EG-Staaten insges. <sup>1)</sup>	102 449

5. 1) Vorläufig bzw. geschätzt 2) Überschätzt 3) Überwiegend o. Investitionsausgaben  
Quelle: OECD (1992)

**Gross Domestic Expenditure on Research and Development (1990) in \$ Millions Purchasing Power Parities**

Key: 1. Germany (original federal laender) 2. France 3. Great Britain (1989) 4. EC countries as a whole 5. 1) Provisional or estimated 2) Overestimated 3) Predominant or investment expenditure 6. Source: OECD (1992)

national economies considered here, Japan's expenditure was nearly twice as high, and that of the United States nearly five times higher.

Industry is by far the major protagonist in German research. It pays for more than 63 percent of Germany's gross domestic expenditure on R&D and finances more than 86 percent of its own R&D work. This rate, exceeded only by Japan with 98.5 percent, shows that German industry draws predominantly on its own resources.

An important problem encountered when making international comparisons of national research capacities is at times considerable scale of military R&D (e.g., 62.6 percent of total state R&D spending in the United States, 44.8 percent in the United Kingdom, and 13.5 percent in Germany), which does not contribute directly to the international competitiveness of the national economy but is included in the R&D statistics. In Germany, spending on this head is comparatively low, as becomes clear in the comparison of state-financed expenditure on civil R&D, where German spending is nearly half (\$10.5 billion) in absolute figures (measured in purchasing power parities) that of the United States (\$23.9 billion), whose economic productivity in terms of GDP is about five times greater. Germany is thus ahead of Japan, whose national economy is nearly twice as large but

which spends a much lower amount of state R&D funds (\$9.3 billion) on civil research.

State-Financed Expenditure* on Civil R&D (1990)		
	(In Million \$**)	As Percentage of GDP
Germany (original federal laender)	10451	0.90%
France	8408	0.85%
Great Britain	4674	0.52%
EC countries as a whole <sup>1</sup>	36183	0.71%

\* Budget allocations, in some cases provisional figures. \*\* purchasing power parities

## 5.2 Innovative Work in German Industry

A look at the sales revenue structure of German companies according to product life cycle provides a good basis for forecasting the medium-term development of Germany's international competitive position. Stages can be distinguished:

- shrinkage
- stagnation
- growth, and
- market launch.

A survey by the Ifo Institute on innovative work in western German industry in 1991 found that the managers questioned estimated that the proportion of products in the shrinkage or stagnation phase had increased

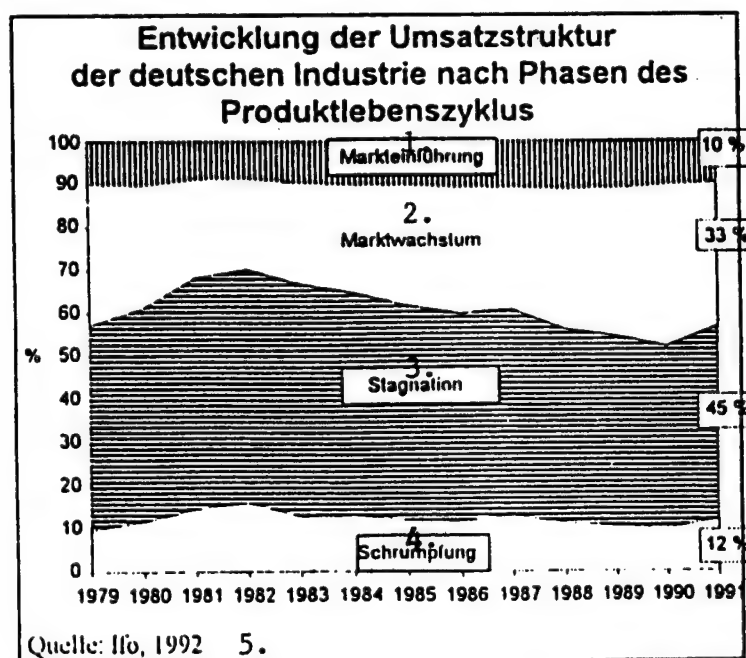
markedly, by 4 percent, compared with recent years. This was happening at the expense of products in the growth phase.

This also shows that German industry must again devote more of its innovative energy to new, competitive products for markets with a high growth potential, and should venture into new sectors more aggressively than before. It is important to prevent Germany's industrial products from "aging."

## 5.3 International Trade in Patent Rights and R&D Services

Germany's export trade in R&D services achieved a surplus in 1991. As a result, there are signs that Germany can claim advantages as a center for science and research<sup>13</sup>. In spite of this overall positive image, it is evident that expenditure has risen much more sharply than revenue compared with the last year under review. The negative change in this balance of trade is largely due to the increase in German R&D expenditure abroad in the electrical engineering industry and data processing, which alone account for half the changes in the balance. Expenditure on R&D abroad also increased considerably in the chemical industry in 1991.

The Federal Republic's revenue from patent rights<sup>14</sup> amounted to less than half its expenditure in this sector in 1991. It is evident that companies with capital interests abroad usually have much lower revenues and spend markedly higher sums on patent rights than do those whose head office is in Germany. These have much



Trend in Sales Revenue Structure in German Industry According to Product Life Cycle Stages

Key: 1. market launch 2. market growth 3. stagnation 4. shrinkage 5. source: Ifo, 1992

higher revenues in this sector and a much lower expenditure than the first group. This indicates that inter-group patent right fees are also used to a certain extent for transferring profits, as a result of which the international balance is somewhat distorted.

In 1990, too, only the United States had substantial surpluses in revenue from patent rights worldwide, revenue in this sector being about five times higher than expenditure. In contrast, both the Federal Republic and Japan spent many times more on patent rights than they received, although sectors outside the manufacturing industries affect these figures; nevertheless, they indicate that companies with head offices in Germany and Japan obtain a considerable amount of their know-how from international markets. The relevant figures suggest that the Federal Republic and Japan in particular take far greater advantage than other countries of international technology transfer.

#### 5.4 Patents as Pointers to Future Key Areas of Technology

Both the result of technical development work and industry's key areas of industrial interest are reflected in the number of patent applications. Although it can provide no direct information about events on the market, not, in particular, about future market successes, the number of patent applications gives an indication of future events in individual market sectors, usually three to four years in advance.

Only the foreign patent applications laid open to public inspection by the United States Patent Office are considered in the comparison of international patent data given here, the purpose being to ensure that only developments that are potentially important for the world market are taken into account, and that the effects of the different administrative procedures adopted by different patent offices are largely eliminated<sup>15</sup>.

##### 5.4.1 International Patenting According to Product Groups

The member states of the OECD together account for more than 99 percent of the world patents considered here, the G-7 countries alone accounting for 93 percent of world patents<sup>16</sup>. Just under 40 percent of the patents granted fall within the advanced technology category and 25 percent under leading-edge technology. Consequently, more than 60 percent of all patents are granted for inventions in the R&D-intensive sectors.

In the leading-edge technology sector, the greatest amount of patenting takes place in electronics, communications engineering, and optical, medical, and measuring instruments. Textile paper, and printing machinery (work machines) and office machines and computers are the main fields in advanced technology.

#### World Patent Applications in the R&D-Intensive Sector

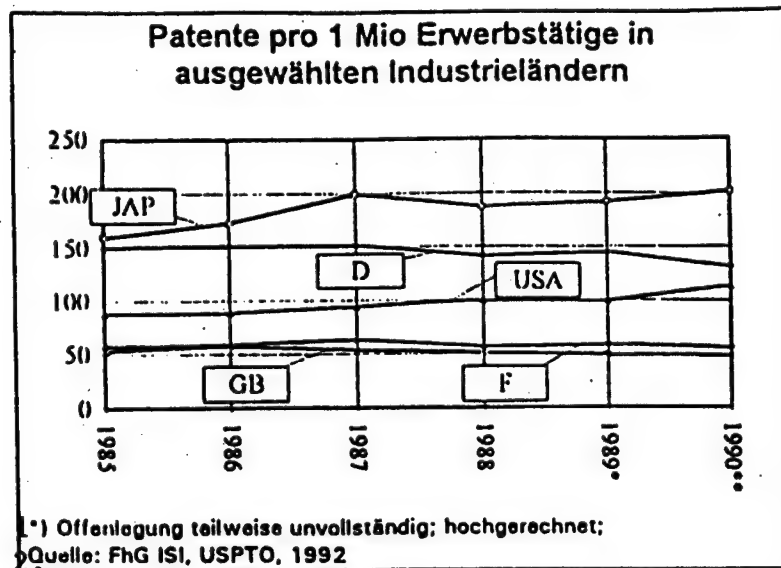
Proportion of patents as percentage	R&D-intensive product groups	Average annual percentage increase 1983-1990
13.4	Medical, measuring instruments	6.7
0.2	Rail vehicle engineering	4.0
2.2	Motor vehicle engineering	6.0
1.2	Home electronics	6.2
2.6	Electrical circuits	6.8
2.1	Service machines	5.5
3.7	Work machines	1.7
2.1	Metal processing	1.5
2.1	Building, handling machinery	1.8
1.6	Plastics, resins	5.8
2.5	Fine chemicals	0.3
1.2	Aerospace	5.1
3.9	Leading-edge electrical engineering	6.2
13.4	Communications, electronics	8.9
3.9	Office machines, computers	6.5
1.0	Turbines, power stations	5.6
1.9	Agrochemicals	4.7
2.4	Pharmaceuticals	4.5

Source: FhG ISI, USPTO: 1992

A closer look at the patents granted in the R&D-intensive sector reveals that the acceleration of technical change seems to be more pronounced in leading-edge technology than in advanced technology. The increase in patents granted in the pharmaceuticals, turbine, and plastics sector has been particularly rapid compared with previous years. Even the classic sector of the chemical industry, where patent applications have been declining for many years, is now showing a slight growth again in the pharmaceutical sector, though it is still below average. Many of the strong growth areas in leading-edge technology are to be found specifically in the sectors dependent on microelectronics, e.g., advanced electrical engineering, which also includes inventions in laser engineering and energy-saving bulbs. The number of patents granted in communications and electronics is growing by nearly 9 percent per year, and the number of patents for service machines such as automatic cash dispensers is growing by more than 5 percent.

##### 5.4.2 National Specifications in Innovation in the R&D-Intensive Sector

Among the G-countries, Japan occupies first place (200) in terms of the "number of patents to number of persons employed" ratio (patent intensity)<sup>17</sup>, followed by Germany (post-unification) with about 130 patents granted



**Patents per Million Persons Employed in Selected Industrialized Countries**

Key: 1. \*Laying open to public inspection incomplete; extrapolated 2. Source: FhG ISI, USPTO, 1992

per million persons employed. The United States follows with 110, with France (56) and Great Britain (48) trailing behind. Germany's relatively strong position reflects a high overall patenting rate, even in the less R&D-intensive sector, so it cannot be seen to specialize specifically in R&D-intensive inventions.

As far as leading-edge technology alone is concerned, Japan has a good technological position here too, though it was unable to expand it in the eighties. In purely quantitative terms, the gap between the Federal Republic and the United States is not very large in view of the far bigger American economy. The situation in the advanced technology sector is completely different, with Germany and Japan having the greatest patent intensity among the G- countries. In recent years, Japan has held its lead over Germany, and was even able to consolidate its above-average specialization in the eighties.

#### 5.5 Foreign Trade Specialization and Patents Granted in Major Industrialized Countries in the R&D-Intensive Sector

As a new way of examining this aspect, the foreign patent applications laid open to public inspection by the United States Patent Office from invention years 1986 to 1988 are compared below with the export trade results [of the countries concerned] for 1990, the relevant standardized levels of specialization<sup>18</sup> being shown in graphs. It is useful to analyze these different periods in time because experience has shown that patenting dates effects trade by about four years.

The comparison of export trade specialization and patenting produces an overall picture of the strengths and weaknesses of the individual countries in terms of both

indicators, and thus provides an indication of future events in individual market sectors.

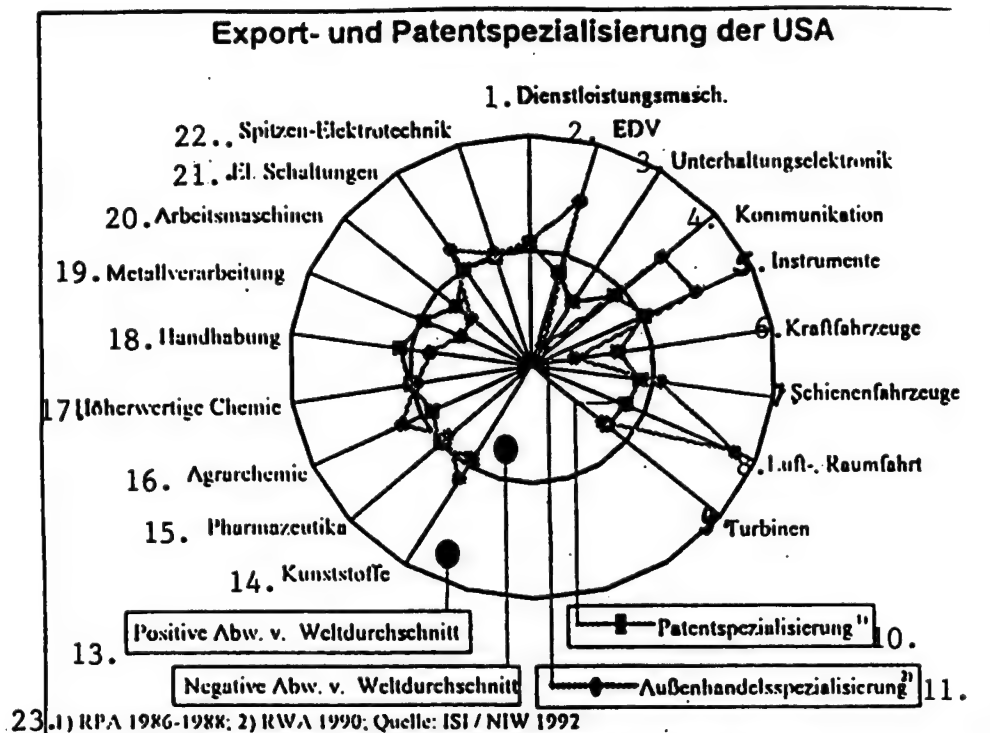
In terms of patents granted, the United States covers all the R&D-intensive areas fairly evenly. It is noticeable that in those very sectors where the United States has a very strong trading position, patenting remains below the world average. Only in mechanical engineering and the automobile industry does the trading position lie well below the patent position.

In the case of Japan, the pattern is clearly selective, with key areas of emphasis in both patents and export trade. In every area where there are specialization advantages in foreign trade, the pace of patenting is brisk. This underlines the efforts being made to develop existing strengths in trade even further, except for aerospace, where, despite an above-average patent rate, the trading position has hitherto been weak.

The patent rights of the GDR have been included in the patent specialization of Germany, but not its export trade figures for 1990. In view of their relatively minor importance, however, this does not noticeably affect the results. The pattern for Germany shows an impressive symmetry not only in structure but also in the figures for patent specialization and export trade specialization.

The fact that the patent rate as an advance indicator is low in home electronics, communications, and EDP suggests that a rapid improvement in the weak export trade position is unlikely. The situation in leading-edge electronic engineering (which includes laser engineering) is still balanced, although the relative lag in terms of patents granted might suggest that the trading position will weaken in the future. On the whole, the good balance





**Export and Patent Specialization in the United States**

Key: 1. Service machines 2. EDP 3. Home electronics 4. Communications 5. Instruments 6. Motor vehicles 7. Rail vehicles 8. Aerospace 9. Turbines 10. Patent specialization<sup>1</sup> 11. Export trade specialization<sup>2</sup> 12. Shortfall compared with world average 13. Surplus compared with world average 14. Plastics 15. Pharmaceuticals 16. Agrochemicals 17. Fine chemicals 18. Handling 19. Metal Processing 20. Work machines 21. Electronic circuits 22. Leading-edge electrical engineering 23. 1) RPA 1986-1988; 2) RWA 1990; Source: ISI/NIW 1992

maintained between patent and trading position shows that German industry is making great efforts in its strongest export sectors to maintain and consolidate its trading position.

### 5.6 Strategic Sectors of Industry

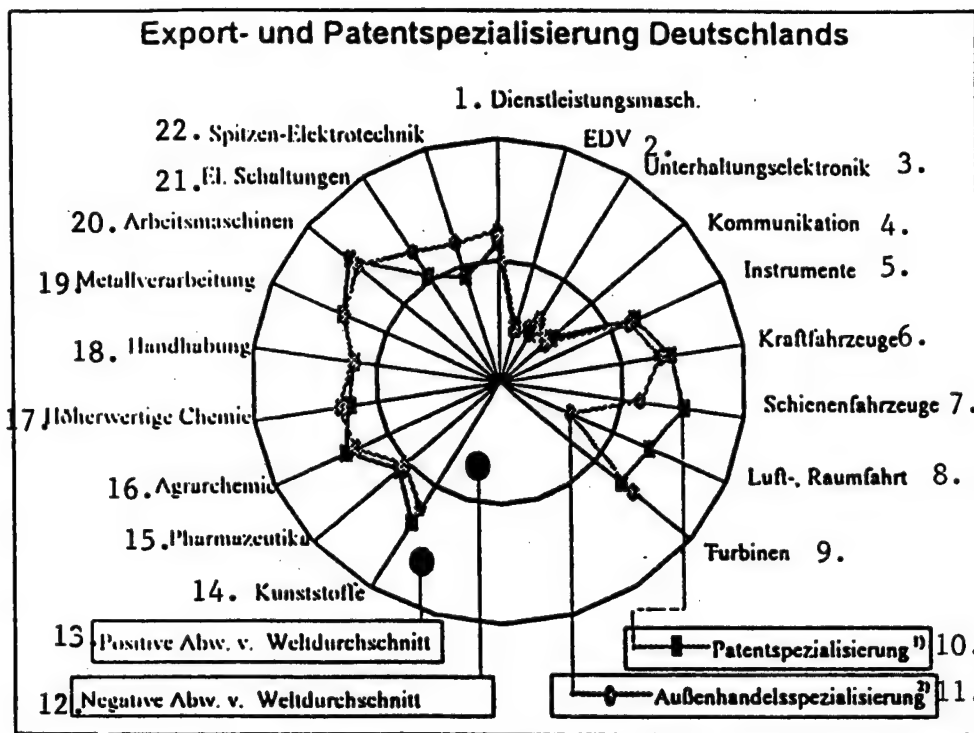
The microelectronics and information technology industry is still a key factor in the struggle for technological competitiveness. As has been mentioned many times, information technology as a component of foreign trade is not one of Germany's particular strengths. In leading-edge technology there has been a slight improvement in semiconductor components. Germany's position (original federal laender) in terms of office machines and home electronics worsened again in 1990 compared with 1989.

The R&D-intensive products of the chemical industry are among the most pronounced export strengths of the German economy. Even in the leading-edge technology sector, where Germany as a whole shows a slight deficit, chemistry achieves clear export surpluses. In terms of patents granted, Germany is now the last major industrialized country to cover the full technological range of

chemicals and processes. German industry is decidedly top-heavy in terms of patents based on conventional chemistry, even where the development of products and processes for which companies elsewhere have gone over almost exclusively to modern biotechnology is concerned. It is thus not inconceivable that German industry will once again have to face increased competition from abroad in the foreseeable future in certain areas of the chemical industry in which it currently enjoys an extraordinarily strong position. At the same time, this trend underlines the growing importance of biotechnology<sup>19</sup>. Efforts in this sector, where Germany already has a good position, must therefore be stepped up.

Given the traditional export strengths of the original federal laender, there are good opportunities for sales and growth in environmental engineering, particularly as industry in the original federal laender has taken the lead in many environmental sectors. Environmental engineering in all its manifestations is a key sector, as is information and communications technology.

In 1991, exports of environmental engineering products from the original federal laender were worth just under



Key: 1. Service machines 2. EDP 3. Home electronics 4. Communications 5. Instruments 6. Motor vehicles 7. Rail vehicles 8. Aerospace 9. Turbines 10. Patent specialization 11. Export trade specialization 12. Shortfall compared with world average 13. Surplus compared with world average 14. Plastics 15. Pharmaceuticals 16. Agrochemicals 17. Fine chemicals 18. Handling 19. Metal processing 20. Work machines 21. Electronic circuits 22. Leading-edge electrical engineering

DM37 billion<sup>20</sup>. Potential environmental products thus account for just under 6 percent of exports<sup>21</sup>. German industry held the highest share (21 percent) of the world market in this sector in 1990. Germany has special strengths in the production of environmental engineering products, particularly in waste disposal and effluent technologies. It also has marked comparative advantages in measurement and control instruments and in clean-air technology. On the whole, environment products have decidedly greater comparative advantages than the average R&D-intensive products. Seen in this light, the starting position for German industry in this increasingly international growth market can be regarded as favorable.

#### Footnotes

1) Nevertheless, German industry, which is running at 98 percent of capacity, is well above its average for many years (Panel of Experts for Assessing Overall Industrial Development, annual report 1992-1993, pp 7 ff).

2) German Institute of Economic Research [DIW], Analysis of the Structural Development of German Industry, Berlin 1992, page 89.

3) Panel of Experts for Assessing pp 4f.

4) Analyses by the FhG-ISI and the Lower Saxony Institute of Economic Research (NIW), 1992, unpublished.

5) Cf., for example, Panel of Experts for Assessing p 262.

6) Cf., for example, Panel of Experts for Assessing p 261.

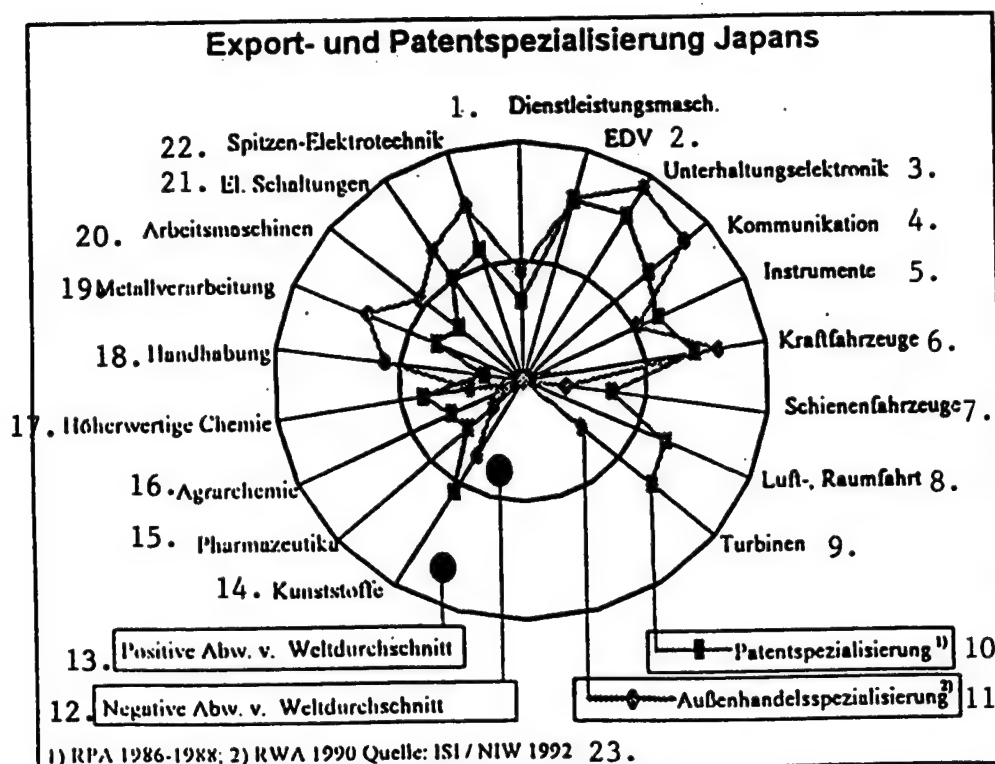
7) DIW Weekly report 44/92. The Position of World Industry and German Industry in Fall 1992, p 562.

8) In the aerospace sector, the cross-border exchanges of Airbus assembly parts affect the results.

9) Compared with the situation in the original federal laender, the advanced plastics sector comes across as positive.

10) A structural comparison between the original and new federal laender in terms of the significance of individual R&D-intensive products in foreign trade in 1991, and the trend with regard to the previous year poses methodological problems in that three-digit export and import figures for 1991 according to SITC [Standard





**Export and Patent Specialization in Japan**

Key: 1. Service machines 2. EDP 3. Home electronics 4. Communications 5. Instruments 6. Motor vehicles 7. Rail vehicles 8. Aerospace 9. Turbines 10. Patent specialization 11. Export trade specialization 12. Shortfall compared with world average 13. Surplus compared with world average 14. Plastics 15. Pharmaceuticals 16. Agrochemicals 17. Fine chemicals 18. Handling 19. Metal processing 20. Work machines 21. Electronic circuits 22. Leading-edge electrical engineering 23. 1) RPA 1986-1988 2) RWA 1990 Source: ISI/NIW 1992

International Trade Classification] III are available only for Germany as a whole, not for the two sub-regions. Consequently, selected two-digit figures must be used for a rough structural comparison; these mostly cover R&D-intensive product groups.

11) Panel of Experts for Assessing p 7.

12) For Japan, different statistical surveying methods have limited international comparability of spending on most of the OECD indicators. In most cases, this leads to an overvaluation of the Japanese data.

13) Source: German Federal Bank 1992, unpublished.

14) Property rights, comprehensive inventions, patents, processes, and copyright. It should be borne in mind that sectors such as the film industry are also included in some cases. For other reasons, which cannot be discussed here, these figures should only be taken as a rough guide.

15) The patent data collected at the United States Patent Office (USPTO) is filed in a particularly detailed manner that facilitates the classification of patents in terms of

applications (product groups). Moreover, the USPTO classifies patent applications not only according to technical criteria but by sector as well. The values for the U.S. were corrected in this analysis with regard to the domestic advantage on its own internal market.

16) "World" means inventions with foreign applications filed in the three main regions, i.e., the United States, Europe, and Japan, and granted in the United States at least. The data from the USPTO is used to compile product statistics.

17) Values based on patents granted in 1990, extrapolated. Source: FhG ISI, USPTO, 1992.

18) The degree of patent specialization, RPA, an indicator with similar characteristics to the RWA, can be used like the RWA to interpret patenting in certain technology categories.

19) Modern biotechnology affects various branches of industry: In addition to medicine, the chemical industry, and pharmaceuticals, the food and gourmet sector, agriculture, and, indirectly, the various branches of the

nascent environment industry are emerging in this connection. Although the term "biotechnology" was originally associated by the man in the street with genetic engineering, or even with modern transplant surgery, biotechnology is now making an impact in the food industry and in environmental conservation and reclamation.

20) The environmental protection products group is defined here in terms of potential, i.e., it embraces all goods that can be used in environmental work.

21) Effluent treatment technologies accounted for just one-half of exports, measurement and control systems for DM10 billion, clean-air products for DM6.5, and waste disposal systems for over DM4 billion.

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ISI List	R&D-Intensive Goods as per SITC III		July 1990
No.	SITC III	Abbreviated description (ISI Terminology)	R&D Intensity
1	516	New organic chemicals	Leading-edge
2	525	Radioactive materials	
3	541	Pharmaceuticals	
4	575	Advanced plastics	
5	591	Agrochemicals	
6	714		
7	718	Nuclear, wind-powered, and hydroelectric power stations	
8	752	EDP systems	
9	764	Telecommunications	
10	774	Medical electronics	
11	776	Semiconductor components	
12	778	Advanced electronics	
13	792	Aerospace	
14	871	Advanced optics	
15	874	Advanced measuring instruments	
16	266	Synthetic fibers	Advanced technology
17	277	Advanced abrasives	
18	515	Heterocyclic chemistry	
19	522	Rare inorganic materials (superconductors)	
20	524	New inorganic substances	
21	531	Synthetic dyes	
22	533	Pigments, coating materials	
23	542	Medicinal products	
24	551	Aromas and Flavorings	
25	574	Advanced polyesters	
26	598	Advanced chemicals	
27	663	Technical ceramics and the like	
28	689	Rare metals	
29	724	Textile machinery	
30	725	Paper machinery	
31	726	Printing presses	
32	727	Food processing	
33	728	Advanced machine tools	
34	731	Metal machine tools	
35	733	Cermet machine tools	
36	735	Machine tool parts	
37	737	Welding robots	
38	741	Industrial engineering	
39	744	Handling machinery	
40	745	Special machinery	

ISI List	R&D-Intensive Goods as per SITC III		July 1990
41	746	Roller bearings	
42	751	Office machines, word processing systems	
43	759	Advanced EDP accessories	
44	761	TV, video sets	
45	762	Mobile telephones	
46	763	Glass-fiber cables	
47	772	Conventional electronics	
48	781	Motor cars	
49	782	Commercial vehicles	
50	791	Rail vehicles	
51	872	Medical instruments	
52	873	Conventional measuring instruments	
53	881	Photographic and film equipment	
54	882	Photographic material	
55	884	Glass fibers and lenses	

### France: Thomson's Restructuring Strategy Discussed

93WS0284C Paris LE MONDE in French 5 Feb 93  
p 17

[Article by Pierre-Angel Gay and Caroline Monnot: "Thomson SA's New Focus"; first paragraph is LE MONDE introduction]

[Text] In the space of just a few months, the group has begun withdrawing from semiconductors and sold off its household appliance division. Thomson has resigned itself to keeping its consumer electronics business, but has designs on the missile industry.

The whole problem is making ends meet at month's end. For the last two years, Thomson SA has come up with one expedient or another in late December to keep the equity of its consumer electronics subsidiary, Thomson Consumer Electronics (TCE), positive. These plays save the public group—and the state, which is its shareholder—from having to dig into its pocket. In late 1991 the device used was the "patents affair." Thomson SA wangled a \$210 million advance dividend from the American firm General Electric, in exchange for postponing its full ownership of their joint venture, RCA Licensing (see LE MONDE, 2 May, 1992).

In late 1992 Thomson SA sold Thomson Electromenager (TEM) to Italy's Elfi for about 2 billion French francs [Fr]. Jean-Marc Poinson, Thomson SA's plan director and Thomson-CSF's director of strategy, points out that "There was no synergy between TEM and the rest of a group that had been focused on electronics since 1969. But the subsidiary desperately needed to acquire a European dimension. Elfi was probably the best industrial

choice possible. We were prepared to divest—but not to invest." That is about as clear as it gets.

The expedients are accepted at Thomson SA's headquarters without fuss, but also without undue anxiety. They are considered merely incidental, or routine accidents, next to CEO Alain Gomez's real priority, which has not changed for 11 years: the defense electronics of his Thomson-CSF subsidiary. There is no doubt that Mr. Gomez would have sacrificed everything to defense electronics, had he not had the state as his inconvenient stockholder—and customer. It is a priority that can still be read between the lines of the group's moves over the last few months, following the rupture caused by the government's now-shelved plan to create a big high-technology concentration, Thomson CEA-Industrie.

Originally, Mr. Gomez was supposed to give up all of his responsibilities, except Thomson-CSF. "Paradoxically," explains Mr. Poinson, "discussions focused only on an assessment of Thomson's consumer electronics branch, TCE. Thomson SA had good reason to believe the subsidiary had real value, given its market shares in television sets, both in North America and Europe. The person we were dealing with, Jean Syrota—who had no synergy to develop with TV manufacturing—took just the opposite line." The deal was not struck. Or rather, it was only struck halfway, since the state's fine print called for a marriage of SGS-Thomson, the Franco-Italian semiconductor maker for whom Thomson SA had been acting as industrial operator, with the Atomic Energy Commission's industrial subsidiary (CEA-I) and France Telecom.

But again, when measured against the group's dominant business of military electronics, this new partial withdrawal stirs no regrets. "Twenty years ago defense was a driving force in microelectronics. It has lost that role to computers, telecommunications, or even automobile electronics. It now accounts for only 3 percent of component purchases," explains Mr. Poinson. As for components needed in military applications, they have remained the specialty of various Thomson-CSF subsidiaries—separate from SGS-Thomson—which the group is said to be considering merging.

Measured against any restructuring yardstick, Mr. Gomez's policy is undeniably successful. Even dizzyingly so, in the opinion of some of his troops, who no longer grasp the logic of it. "Getting back to our basic businesses? The notion of business is not really clear. Henceforth, Thomson SA is restructuring even within its businesses," argues a trade unionist. The unionist notes that a long string of restructurings has left Thomson with only two of the 22 businesses it pursued when Mr. Gomez signed on 11 years ago. And that is counting consumer electronics, which the shocktrooper CEO—or paratrooper as the English-language press has nicknamed him—has more than once dreamed of scrapping.

Yet this time Thomson SA's top management seems to be making the best of a bad situation. And top executives

apparently believe that consumer electronics—with its seemingly unstoppable slide in sales (Fr36 billion in 1989, Fr31.1 in 1992) and rise in losses (-Fr2.6 billion in 1990, -Fr2.47 in 1992)—can recover. "The price war may abate," explains a Thomson SA official. "First of all because our competitors—look at Philips's problems—are all losing money. Second, because the Japanese manufacturers who now control 60 percent of the world television market stand to gain by favoring margins over increased market shares. In the past TCE has based its forecasts on annual price drops of 10 percent. If those drops were to level off and fall by just one half, TCE's chances of recovery would be geared down (sic)."

And then there is what Thomson and ministry people privately call the "Alain Prestat" effect, after the subsidiary's new CEO. Mr. Prestat's youthful enthusiasm is no stronger than his determination to "clean house": He has made sweeping changes in team staffing and shaken up professional and management personnel. TCE's inventory has been cut in half, and the agreement with designer Philip Starck to update the product look of the group's many brandnames (Thomson, Telefunken, Saba, Brandt, Normende, Ferguson, RCA, General Electric, etc.) has caused a sensation. Finally, Mr. Prestat cracked the whip in U.S. sales departments, boosting TCE's market share for television sets from 17 to 20 percent of the American market—with 10 percent less staff.

"In 1993 and 1994 I will focus on the challenge of Europe," confides Mr. Prestat. The CEO will aim for a recovery in operating results (-Fr228 million in 1991, and from -300 to -330 last year) since the company's debt of Fr14 billion prevents him from acting on interest expenses. And TCE has no immediate prospects of fresh capital: From the corridors of power to the headquarters of Thomson SA, everyone seems to have decided to see what the young CEO can do, and to wait for the potential payoff of a policy to "reposition" brandnames in Europe. In order to do what? "To sell TCE, as soon as the March elections are over," as some trade unionists fear? "To ally it with another big consumer electronics group, as soon as it has recovered," as is sometimes whispered in the circles of power? Or "because Thomson was a bit hasty in abandoning this branch of the industry," as Mr. Prestat claims?

Thomson-CSF is not asking itself those questions, now that the priority given to defense electronics is more obvious than ever. Yet judging from the severe crisis in the weapons industry, Thomson is swimming against the current. Everywhere, hardware expenditures and big programs are being scaled back to save budget monies. Export markets are more and more hotly contested, and sweeping efforts to rationalize production are being made.

The American firm Hughes is taking over General Dynamics's missiles business (nearly Fr8 billion in sales). The same General Dynamics is selling off its combat aircraft division to Lockheed, and Martin Marietta is acquiring all of General Electric's aerospace

activities. Each of these transfers involves billions of dollars in business. With each reconfiguration, the players, whose numbers are steadily dwindling, become more integrated. Aircraft makers are becoming electronics manufacturers or missile builders.

Despite Thomson-CSF's entrenchment and its rank as the world's second-biggest defense electronics manufacturer (sales of Fr35 billion) after Hughes, this sweeping trend toward industry concentration could marginalize the firm. Thomson must constantly make acquisitions or find allies. Buying is difficult, even when you can pay the price. Negotiations for large-scale acquisitions are extremely delicate. "In the weapons industry, national rather than industrial thinking applies," noted a high-ranking civil servant in the armaments industry a short while ago. "When Alain Gomez fully realized this, he was quite disturbed about it."

As for allies, Thomson-CSF is negotiating right and left. Its goals are to maintain sales, penetrate markets that the recession is making more and more protectionist, and pursue a more complete range of businesses. The group has teamed up with GEC-Marconi on fighter-plane radar and cooperates with Ferranti on sonars. Now it is looking for its big alliance in missiles. Missiles: one of the rare niches that is still lucrative and, according to observers, should remain so because of replacement needs. The profits racked up by the American group Raytheon from the Patriot alone spark admiration and envy. (Raytheon is totally integrated and designs everything, from the missile itself to its guidance systems.) "Sure access to a missile manufacturer guarantees independence," pleads the French group.

When in the spring of 1992 word got out that Thomson might be combined with a missile maker, top management at Aerospatiale and Matra was startled. At the time, the French group seemed well positioned to take over the missiles division of the LTV conglomerate in the United States. In the end the deal fizzled, but the debate still rages. The government fully intends to take advantage of the controversy to reorganize defense industries. "One thing is clear, France will not have three missile manufacturers." Of the three possibilities—a Matra-Aerospatiale alliance, a Thomson-Aerospatiale alliance, or, highly unlikely, a single concentration—which will prevail? The manufacturers are talking while the Defense Ministry and Elysee study the matter.

The answer will hinge on money, strategic interest, and people. The cool relations between Thomson SA's boss and his counterpart at Aerospatiale have warmed up since Louis Gallois, a veteran of the same Chevenement circles as Mr. Gomez, succeeded Henri Martre. But Deutsche Aerospace, which is a partner of Aerospatiale and Thomson-CSF in the Euromissiles group, must also be figured into the equation.

Military affairs are a state concern. So is civilian electronics—all of whose groups are struggling—assuming

that Europe does not throw in the towel. The question is whether the best-lit roads will be the ones taken after the legislative elections.

## EAST-WEST RELATIONS

### Germany: ABB To Build Copper Alloy Recycling Factory in Ukraine

93MI0393 *Eschborn NACHRICHTEN FUER AUSSENHANDEL* 22 Feb 93 p 8

[Text] The Dortmund-based ABB Factory Automation AG will ship a complete set of components for a copper alloys recycling and melting plant to Ukraine. The plant is worth 80 million German marks [DM] and as the company reported last Thursday, it should be completed by the end of 1993. The new "Donkavement" factory, based in Donezk, is a partner of the Ukrainian Federation of Companies affiliated with the Waste Recycling organization, the Health Ministry, the municipality of the city of Donezk, and the German company Varex. It will be the most modern plant of its kind in the CIS and will also comply with the strict German regulations on the environment.

## EUROPE-ASIA RELATIONS

### China Involved in DASA, Fokker Controversy

93MI0365 *Munich SUEDEDEUTSCHE ZEITUNG in German* 22 Feb 93 p 17

[Text] Aircraft builder Deutsche Aerospace (DASA) AG, Munich last month held secret negotiations in China. NRC—HANDELSBLATT reports that the aim of the talks was to relocate part of *F 100* (a 100-seater aircraft) production from Amsterdam to China. The reason was said to lower wage costs. The DASA delegation reportedly held talks in Jianxi province and was planning to build a factory in Nanchang. But the Chinese did not accept DASA's proposal because it has only a 51-percent stake in Fokker, so the Chinese do not consider it a "full-value partner." The Chinese also hold DASA responsible for the failure of a joint aircraft venture with DASA subsidiary MBB. It is also reported that in 1992 China held secret talks in The Hague to buy shares in Fokker, but Fokker's directors were not interested in cooperation with China.

### Germany: Nissan Opens Design Center Near Munich

93MI0369 *Munich SUEDEDEUTSCHE ZEITUNG in German* 19 Feb 93 p 28

[Text] Despite the first loss in its 40-year history, Nissan Motor Co., Tokyo, intends to press ahead with expanding its production facilities in Europe and the U.S. Productivity will be steadily increased, the number of models reduced and model cycles extended. The opening of a design center to the south of Munich in the

spring will make the design and development of new models for Europe even more independent. In 1992 Nissan increased sales in Germany despite the fall in new registrations.

With 136,240 cars and station wagons (down 10 percent) and 5,903 commercial vehicles, Nissan Motor Deutschland GmbH, Neuss, sold 7.7 percent fewer vehicles in the Federal Republic in 1992 than in the previous year. But the decline was more than offset by an increase in dealers' stocks and two-figure growth rates in parts and accessories, increasing revenue to 3.35 (previous year 3.2) billion German marks [DM], the company reported. This made Nissan the fastest-selling Japanese firm in the Federal Republic and the second largest importer after Renault.

It went on to say that in 1992 "traditional" vehicles accounted for more than two thirds of sales. The best-selling model was the *Sunny*, followed by the *Primera* and the *Micra*. The remainder were divided between cross-country vehicles like the *Terrano* and *Patrol*, and large limousines like the *Prairie Pro*. The firm ascribes its success on the German market among other things to its ability to deliver even when the car market was booming.

With the new *Micra*, Nissan sees itself as well placed on the growing market for small cars. They hope to cash in on the success of its predecessor model, that was on the market for 10 years and was "by far the most successful Japanese car on the German market." This year Nissan expects to sell up to 28,000 "new" and 6000 to 7000 "old" *Micra* models. The Europe-made *Serena* large limousine and, in the middle of the year, the cross-country *Terrano II* will also be launched on the market.

The European factories in Spain and Great Britain made a profit for the first time in 1991, but the launching costs for new models and the expansion of capacity meant a loss in 1992. Nissan wanted to get back in profit in Europe as quickly as possible, especially as in 1992 the group was in the red for the first time in its 40-year history as a car maker. It was aiming to increase productivity by 10 percent a year for the next three years.

In 1992 the Sunderland plant in Great Britain had cut the time required to make a *Primera* from 14 to 12.5 hours. Nissan wanted to reduce both the number of models and the frequency of model change. The aim was a model cycle of about five years, depending on the vehicle. The number of parts required will be cut by 30 percent throughout the group.

The company says that investment in Great Britain, Spain, and the United States will continue as planned. The proportion of Germany's new Nissan registrations made in Europe will rise to 40 percent this year.



In the spring Nissan will open a design and styling center in Geretsried near Munich. This is a further step in the strategy of designing, developing, and building different vehicles for different markets and a move away from the idea of a universal car. Nissan already has design centers in Japan and the U.S. Geretsried will recognize trends on the European market at an early stage. Nissan Design Europe GmbH (NDE), sited there, will be at the forefront, being responsible for designing vehicles for the Japanese and European markets that will then be developed at the product development center in Cranfield, England, the company said. The design centers will be in competition with each other. According to Nissan, all cars manufactured in Europe for example, the next generation of the Primera, will be designed in Geretsried.

**Ericsson To Expand Cellular Telephone Network in China**

93MI0394 Eschborn NACHRICHTEN FUER  
AUSSENHANDEL in German 22 Feb 93 p 8

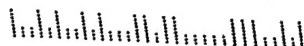
[Text] AB LM Ericsson has signed a contract for the expansion of a cellular telephone network in the Chinese province of Guangdong. The company reported that the contract is worth \$150 million. The network will be run by Guangdong Mobile Communications Corp. This contract, which is one of Ericsson's largest commitments in the People's Republic of China, will enable Guangdong Mobile Communications Corp. to increase the number of its subscribers by 500,000 units. Ericsson considers the People's Republic of China one of its most important markets for public and private communications [equipment].

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